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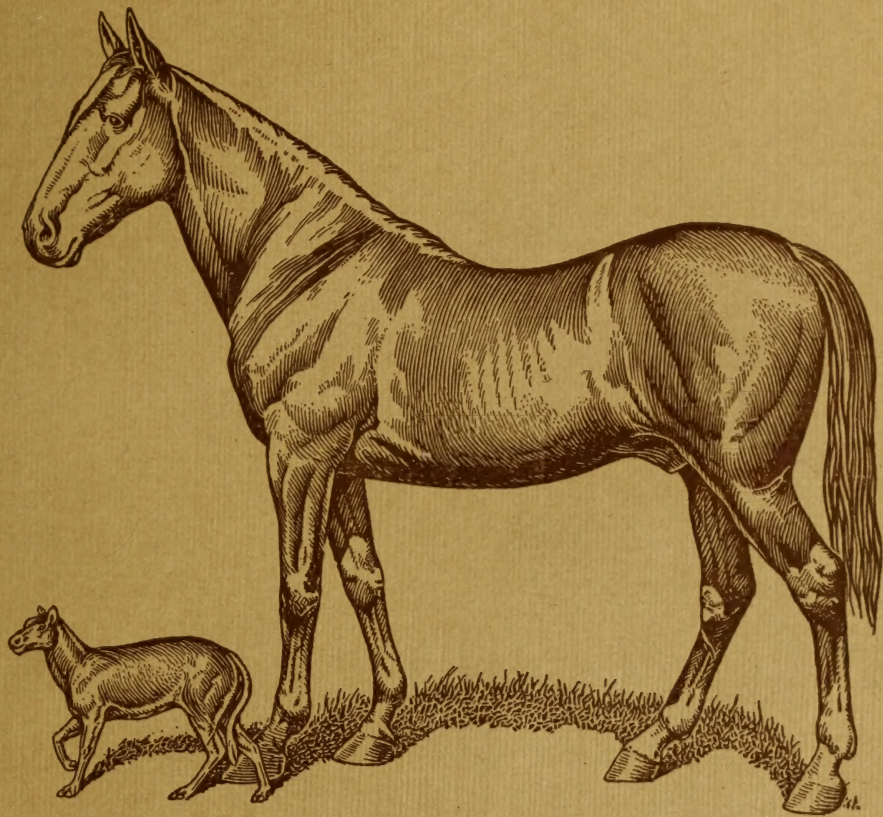
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EVOLUTION OF THE HORSE

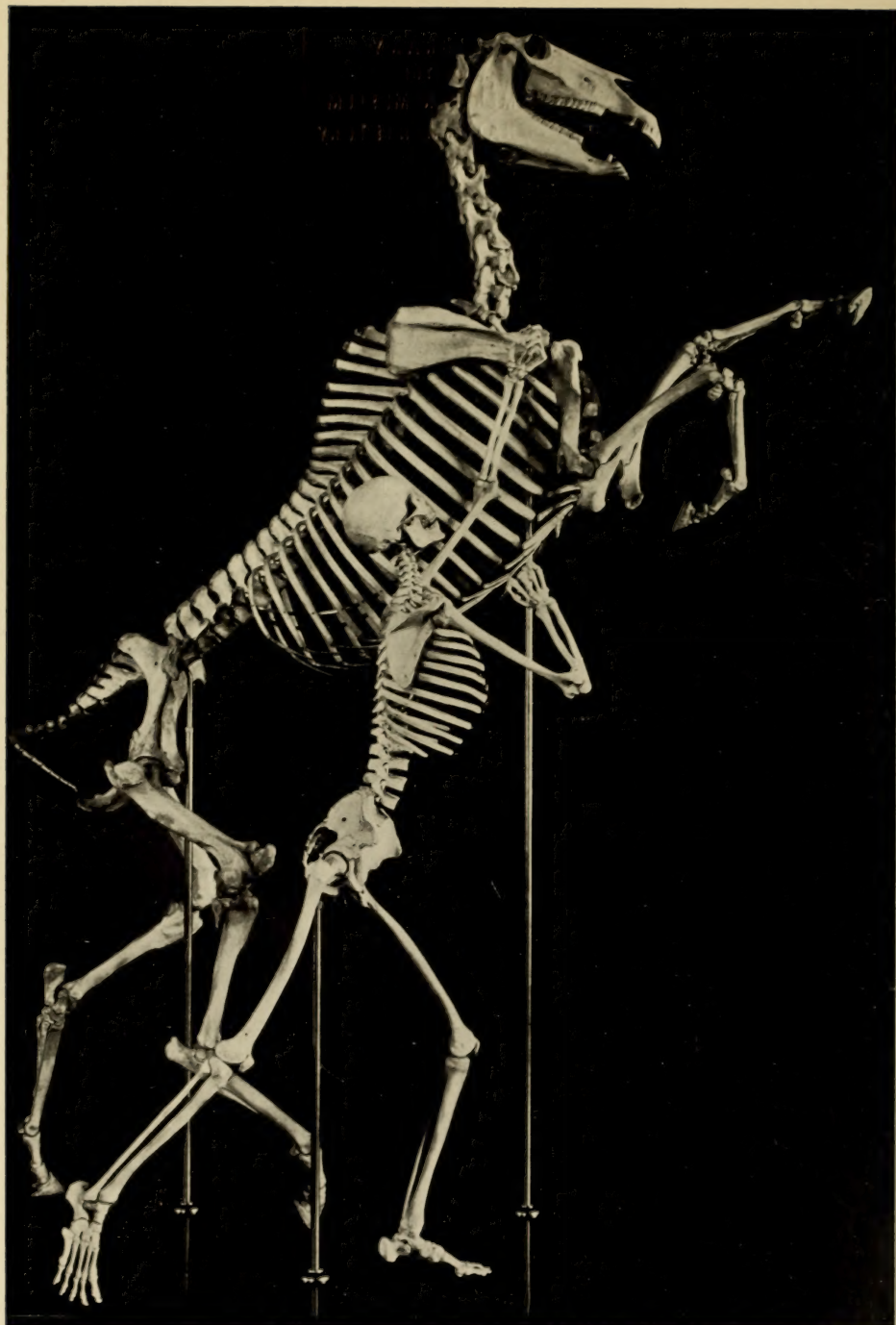


By W. D. MATTHEW AND S. H. CHUBB

NO. 36 OF THE GUIDE LEAFLET SERIES—APRIL, 1921



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After Osborn

SKELETON OF HORSE AND MAN

Mounted for comparative study. Gift of the late William C. Whitney to the American Museum of Natural History

EVOLUTION OF THE HORSE

IN TWO PARTS

EVOLUTION OF THE HORSE IN NATURE

BY

W. D. MATTHEW

THE HORSE UNDER DOMESTICATION: ITS ORIGIN AND THE STRUCTURE AND GROWTH OF THE TEETH

BY

S. H. CHUBB



GUIDE LEAFLET SERIES, No. 36

FOURTH EDITION, REVISED

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“ * * * the general principles of the hypothesis of evolution lead to the conclusion that the horse must have been derived from some quadruped which possessed five complete digits on each foot; which had the bones of the forearm and of the leg complete and separate; and which possessed forty-four teeth, among which the crowns of the incisors and grinders had a simple structure; while the latter gradually increased in size from before backwards, at any rate in the anterior part of the series, and had short crowns.

And if the horse has been thus evolved, and the remains of the different stages of its evolution have been preserved, they ought to present us with a series of forms in which the number of the digits becomes reduced; the bones of the forearm and leg gradually take on the equine condition; and the form and arrangement of the teeth successively approximate to those which obtain in existing horses.

Let us turn to the facts and see how far they fulfil these requirements of the doctrine of evolution.”

Huxley. The Demonstrative Evidence of Evolution.

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PREFACE

Among all the animals of past and present there is none so deserving of our interest and affection as the horse. It is the most useful of the domestic animals, and has played the largest part in the development of civilization. Since the dawn of recorded history the man with the horse has been in the forefront of progress. Whether leading the military civilizations of the past or breaking ground for the industrial civilization of the present the pioneers and leaders of progress have always made large use of this noble animal. It is not too much to say that without his help our ancestors in the Old World might have advanced but little further on the road to civilization than did the inhabitants of the ancient semi-civilized states of Peru and Mexico, where the horse was unknown, and travel, agriculture and military success were limited by the capacity of unaided human strength.

From another point of view the horse is of peculiar interest. It is one of the most perfect machines for swift running that exist among living animals and displays throughout its organization the most exact and finished mechanism adapted to this purpose. It is perhaps the finest example of what nature acting through millions of years, has been able to accomplish in the way of adapting a large quadruped to speed over long distances, and likewise of the extent to which man, during the few thousand years that he has controlled its development, has been able to improve upon nature, in the sense of adapting it to serve more exactly his own purpose.

The history of this adaptation, continued over millions of years, constitutes the evolution of the horse. Its records consist of the actual skeletons of the successive stages in the development of the race. Buried in ancient river deposits, petrified and preserved to our day in the successive geological strata, they have been discovered and disinterred through the diligent search of scientists during the last fifty years.

This Museum has taken especial interest in the evolution of the horse. The records of this history are most completely preserved in the western United States, and through the liberality of the trustees of the American Museum, and in particular through special funds provided by the late William C. Whitney, by Professor Henry Fairfield Osborn and by other trustees and friends of the Museum, Messrs. James R. Keene, Randolph Huntington, F. K. Sturgis and others, we have obtained, from expeditions, gifts and purchases, many thousand specimens of fossil species, illustrating numerous successive stages in horse ancestry; and a unique series illustrating the diverse breeds of the domesticated animal and the structure and growth of its teeth and skeleton, so marvelously suited to its requirements.

Such parts of the collection as might best serve to illustrate the subject have been placed on exhibition in the hall of fossil mammals. These exhibits show

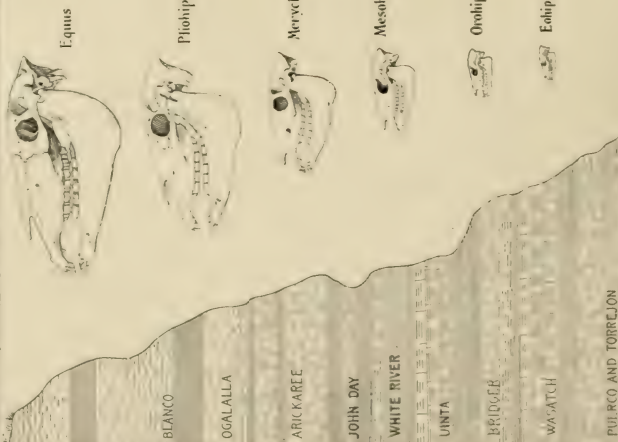
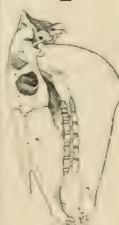





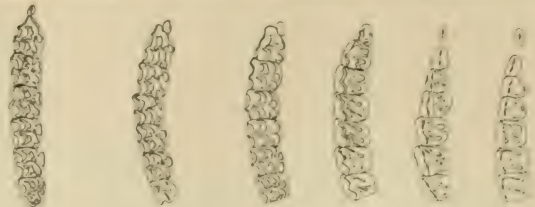
1. THE EVOLUTION OF THE HORSE IN NATURE
2. THE EVOLUTION OF THE HORSE UNDER DOMESTICATION

The collections have been gathered together and arranged under the direction and supervision of Professor Henry Fairfield Osborn. Scientific descriptions of parts of the material have been published from time to time by Professor Osborn and his assistants and an extensive monograph on the evolution of the horse is now in preparation.

W. D. MATTHEW

AMERICAN MUSEUM OF NATURAL HISTORY, *March*, 1913

THE EVOLUTION OF THE HORSE.

THE EVOLUTION OF THE HORSE.										
		Formations in Western United States and Characteristic Type of Horse in Each				Teeth				
Quaternary or Age of Man	Recent									
	Pleistocene									
Pliocene	BLANCO		One Toe Splints of 2 nd and 4 th digits		One Toe Splints of 2 nd and 4 th digits		Long-Crowned, Cement-covered			
Miocene	OGALALLA		Three Toes Side toes not touching the ground		Three Toes Side toes not touching the ground					
Tertiary or Age of Mammals	Oligocene		ABICKAREE	Three Toes Side toes touching the ground; splint of 2 nd digit		Three Toes Side toes touching the ground		Short-Crowned, without Cement		
	Eocene		JOHN DAY WHITE RIVER	Four Toes		Three Toes Splints of 1 st and 5 th digits				
Age of Reptiles	Paleocene		UNTA							The Premolar Teeth become more and more like true molars
			BRIDGE							
			WATCHE							Hypothetical Ancestors with Five Toes on Each Foot and Teeth like those of Monkeys etc.
			PULVERCO AND TORREJON							

Part I. EVOLUTION OF THE HORSE IN NATURE

By W. D. Matthew, Ph.D.

Curator, Department of Vertebrate Paleontology

INTRODUCTION

AS a domestic animal the horse is to be found almost everywhere that man can live. He is spread all over the world—from torrid to arctic climates, in all the continents, in remote oceanic islands—he is completely cosmopolitan. But as a wild animal the horse is at present limited to the Old World, and is found there only in the open arid or desert plains of Central Asia and Africa. There are two species in Asia, the Asiatic wild ass (*Equus hemionus*) and the little known Przewalsky horse (*Equus przewalskii*), while in Africa there are the African wild ass (*Equus asinus*) and the several species of zebra (*Equus zebra*, *Equus burchelli*, *Equus grevyi*). In the Americas and Australia there are no true wild horses, the mustangs and broncos of the Western Plains and South America being feral (domesticated animals run wild) and descended from the horses brought over from Europe by the early white settlers. When the Spaniards first explored the New World they found no horses on either continent. The Indians were quite unfamiliar with them and at first regarded the strange animal which the newcomers rode, with wonder and terror, like that of the ancient Romans when Pyrrhus and his Greeks brought elephants—"the huge earth-shaking beasts"—to fight against them.

The horse is distinguished from all other animals now living by the fact that he has but one toe on each foot. Comparison with other animals shows that this toe is the third or middle digit of the foot. The hoof corresponds to the nail of a man or the claw of a dog or cat, and is broadened out to afford a firm, strong support on which the whole weight of the animal rests. Behind the "cannon bone" of the foot are two slender little bones, one on each side, called "splint bones." These represent the second and fourth digits of other animals, but they do not show on the surface and there is nothing like a separate toe. So that the horse may be said to be an animal that walks on its middle finger nail, all the other fingers having disappeared.

The teeth of the horse are almost equally peculiar. The molars are long, square prisms which grow up from the gums as fast as they wear off on the crowns. Their grinding surface exhibits a peculiar and complicated pattern of edges of hard enamel between which are softer spaces composed of dentine and of a material called "cement," much like the dentine in quality but formed in a different way. The dentine is formed

on the inside surfaces of the enamel while the tooth is still within the jawbone; the cement is deposited on the outside surfaces of the enamel after the tooth has broken through the jawbone and before it appears above the gums.

Various other peculiarities distinguish the horse from most other animals; some of these

are shared by other hoofed animals. The two long bones of the forearm (radius and ulna) are separate in the greater number of animals, but in the horse and in many other hoofed animals, they are consolidated into a single bone (See Fig. 17, p. 27). The same consolidation is seen in the bones of the lower leg (tibia

and fibula). (See Fig. 18, p. 28.)

The lengthening of the foot and stepping on the end of the toe raises the heel in the horse, as in many other animals, to a con-

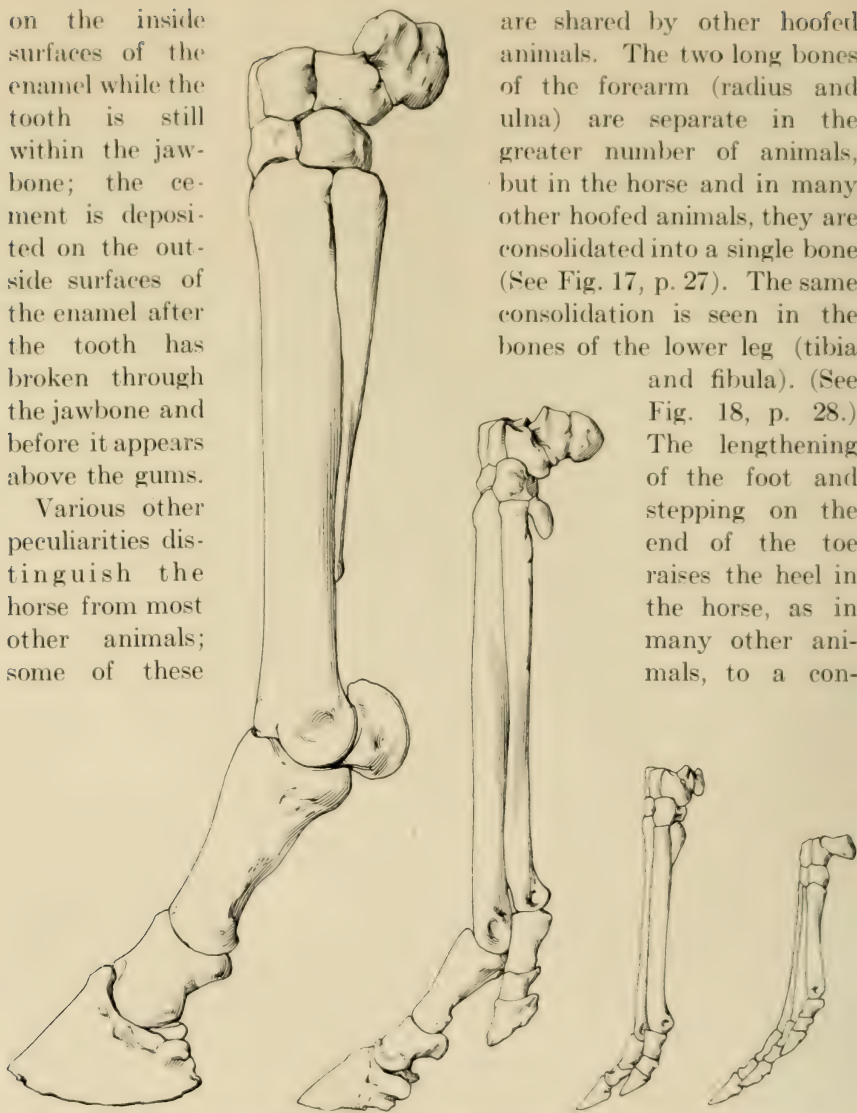


FIG. 2. EVOLUTION OF THE FORE FOOT. PRINCIPAL STAGES

(Right to Left)

1. Four-toed horse *Eohippus*. Eocene Epoch
2. Early three-toed horse *Mesohippus*. Oligocene Epoch
3. Later three-toed horse *Merychippus*. Miocene Epoch
4. One-toed horse *Equus*. Pleistocene Epoch and Modern

All outside views showing the middle and outer digits of the fore foot. In *Eohippus* the two outer toes (digits IV and V) are complete. In *Mesohippus*, digit V is reduced to a small splint and digit IV is notably smaller than the middle digit. In *Merychippus*, digit V is a tiny nodule of bone and digit IV has become very slender in comparison with the middle digit. In *Equus* digit IV is reduced to a long splint, while of the fifth digit no trace remains

siderable height above the ground, where it forms the hock joint, bending backward, as the knee bends forward. In these as in various other ways the legs of the horse are especially fitted for swift running over hard and level ground, just as its teeth are fitted for grinding the wiry grasses which grow on the open plain.

The zebra and the ass have the same peculiar structure of teeth and feet as the domestic horse, and differ only in the color of the skin, proportions of various parts of the body, etc.

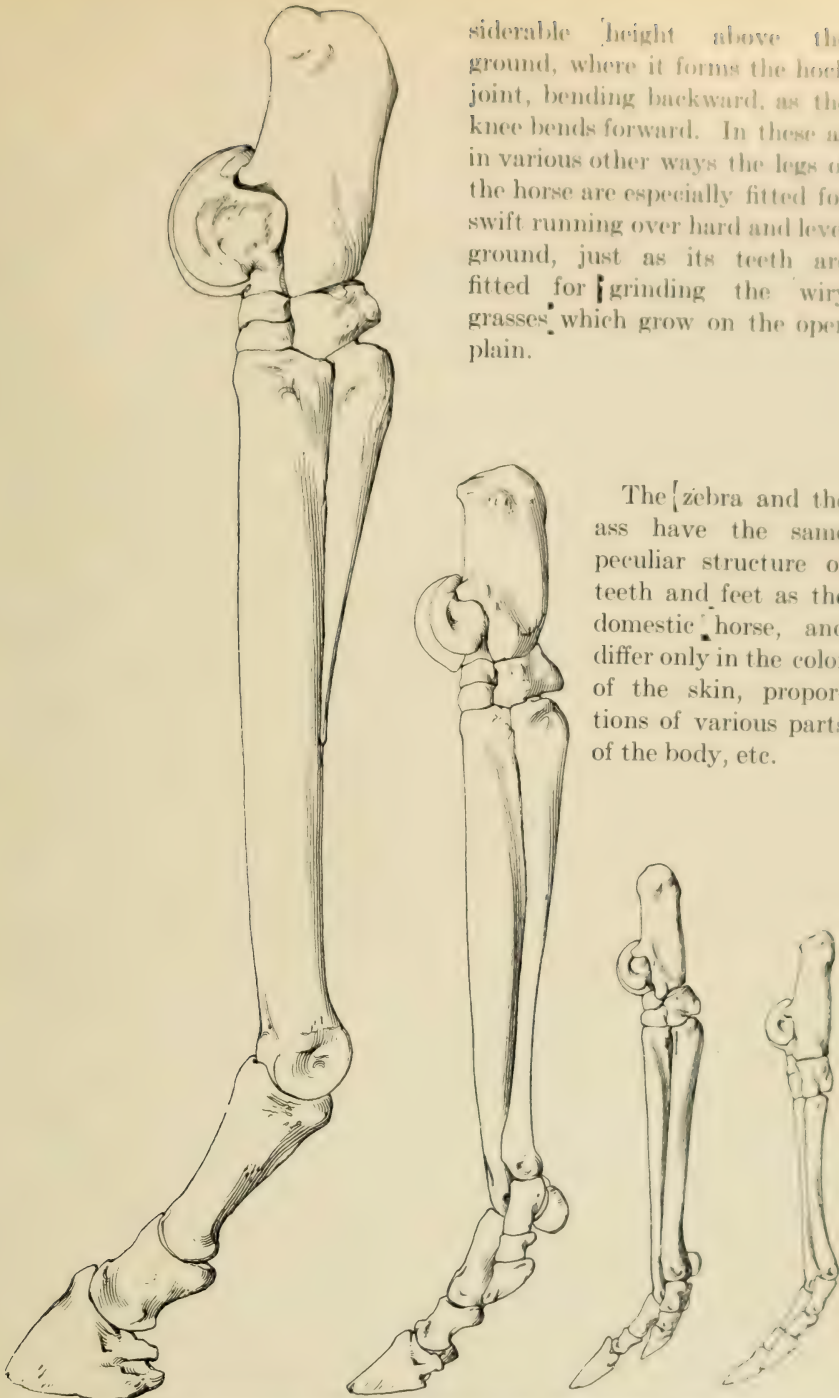


FIG. 3. EVOLUTION OF THE HIND FOOT. PRINCIPAL STAGES

(Right to Left) 1, *Eohippus*, Eocene Epoch; 2, *Mesohippus*, Oligocene; 3, *Merychippus*, Miocene; 4, *Equus*, Pleistocene and Modern

Outer views showing middle and outer digits. Note progressive reduction of side toe (digit IV) from a well developed digit to a splint bone

FOSSIL HORSES OF THE AGE OF MAN

THE Age of Man, or Quaternary Period, is the last and by far the shortest of the great divisions of geological time. It includes the Great Ice Age or Glacial Epoch (Pleistocene), when heavy continental glaciers covered the northern parts of Europe and North America, and the Recent Epoch, of more moderate climate during which civilization has arisen.

In the early part of the Quaternary Period, wild species of horse were to be found on every continent except Australia. Remains of these true native horses have been found buried in strata of this age in all parts of the United States, in Alaska, in Mexico, in Ecuador, Brazil and Argentina, as well as in Europe, Asia and Africa. All these horses were much like the living species and most of them are included in the genus *Equus*. Mr. J. W. Gidley, in charge of the American Museum expedition in northern Texas, discovered in 1899 a number of more or less complete skeletons of a species of fossil horse, *Equus scotti*, in an old river deposit on Rock Creek in Donley County. These are the most complete specimens known of the extinct horses which inhabited this country at the beginning of the Ice Age. A mounted skeleton and several skulls have been placed on exhibition, and their near resemblance to the modern animal appears at a glance. The difference from the domestic horse is chiefly in proportions: the skull is shorter with deeper jaws, the legs rather short and the feet small in proportion to the body. In these characters this fossil horse resembles an overgrown zebra rather than a domestic horse. We know nothing of its coloring. It may have been striped, and in this case would have been very zebra-like; but there are some reasons for believing that it was not prominently striped. The bones are petrified, brittle and heavy, the animal matter of the bone having entirely disappeared and having been partly replaced by mineral matter. They are not much changed in color however, and are so perfectly preserved that they look almost like recent bone.

All the remains of these native horses which have been found in America have been petrified more or less completely. This means that they have been buried for many thousands of years, for true petrification is an exceedingly slow process. This condition serves as an easy means of distinguishing them from bones of the domestic horse, found buried in the earth. These cannot in any case have been buried for more than three or four centuries, and have not had time to petrify.

Remains of these fossil horses from various parts of the United States are shown in the counter cases. One very rich locality is on the Niobrara River in Nebraska, another is in central Oregon. Many separate teeth and bones have been found in the phosphate mines near

Charleston, South Carolina; other specimens have come from central Florida, from southern Texas, Arizona, Kansas, Louisiana and even from Alaska. They are, in fact, so often found in deposits of rivers and lakes of the latest geological epoch (the Pleistocene) that the formation in the western United States has received the name of "Equus Beds."

In South America, in strata of the Pleistocene Epoch, there occurs, besides several extinct species of the genus *Equus*, the *Hippidium*, a peculiar kind of horse characterized by very short legs and feet, and some peculiarities about the muzzle and the grinding teeth. The legs were hardly as long as those of a cow, while the head was as large as that of a race horse or other small breed of the domestic horse.

All these horses became extinct, both in North and South America. Why, we do not know. It is very probable that man—the early tribes of prehistoric hunters—played a considerable part in their disappearance, not indeed by killing them all off directly, but by continual hunting and chasing, driving them from the best feeding-grounds and interfering with their habits and opportunities for grazing. This persecution would tend to reduce their numbers and vigor, and be the prelude to their extinction. The competition with the bison, which had recently migrated to America, may also have made it more difficult than formerly for the American horse to get a living. And finally, some epidemic disease or prolonged season of drought may have exterminated the race. Whatever the cause, the horse had disappeared from the New World when the white man invaded it (unless a few individuals still lingered on the remote plains of South America), and in his place the bison had come and spread over the prairies of the North.

Fossil horses are equally common in the Pleistocene formations of the Old World. They have been found in all parts of Europe and Asia, in North and South Africa, but not in Australasia, the East Indies or Madagascar. In Central Asia, two wild races persist to the present day; others were domesticated by man in the earliest times, and their use in Chaldea and Egypt for draft and riding is depicted in the ancient mural paintings. In Africa the larger species became extinct in prehistoric times, as in America, but the smaller zebras still survive in the southern part of the continent (one species, the quagga, abundant fifty years ago, is now extinct), and the African wild ass is found in the fauna of the northern part. The wild horse of prehistoric Europe, a small race, short-legged and shaggy-haired, was domesticated by man, a fact that is known from the rude drawings scratched on bone or ivory by men of the Neolithic or Polished Stone Age. But the domesticated horses now in use are derived chiefly from the Asiatic and African species¹ although it

¹They are probably derived from three different wild sources which Professor Cossar Ewart has called the Forest Type of Northern Europe, the Steppe Type of Northern Asia, resembling the Przewalsky horse, and the Plateau or Desert Type of Northern Africa, resembling the Arabian—Henry Fairfield Osborn.

is probable that in some breeds there is a considerable strain of this shaggy, short-legged European race. The domesticated ass is a descendant of the wild ass (*Equus asinus*) of North Africa.

THE EVOLUTION OF THE HORSE

THE history of the evolution of the horse through the Tertiary Period or Age of Mammals affords the best known illustration of the doctrine of evolution by means of natural selection and the adaptation of a race of animals to its environment. The ancestry of this family has been traced back to near the beginning of the Tertiary without a single important break. During this long period of time, estimated at nearly three millions of years, these animals passed through important changes in all parts of the body, but especially in the teeth and feet, adapting them more and more perfectly to their particular environment, namely the open plains of a great plateau region with their scanty stunted herbage, which is the natural habitat of the horse.

In the series of ancestors of the horse we can trace every step in the evolution of those marked peculiarities of teeth and feet which distinguish the modern animal from an ancestor which so little suggests a horse that when its remains were first found forty years ago, it was named by the great palæontologist Richard Owen, the *Hyracotherium* or "coney-like beast." Its relation to the horse was not at that time suspected by Professor Owen, and was recognized by scientific men only when several of the intermediate stages between it and its modern descendant had been discovered. On the other hand this first ancestor of the horse line is very difficult to distinguish from the contemporary ancestors of tapirs and rhinoceroses, and indicates how all the modern quadrupeds have diverged from a single type, each becoming adapted to the needs of its especial mode of life.

FOUR-TOED HORSES

THE earliest known ancestors of the horse were small animals not larger than the domestic cat, with four complete toes on each fore foot and three on each hind foot. There is reason to believe that still more ancient ancestors of this and all other mammals had five toes on each foot. In the fore foot of the earliest known stage there *may* have been a small, slender rudiment representing the missing first digit or thumb, which no longer appeared on the surface of the foot,¹ while in the hind foot there is a similar rudiment representing the outer or fifth digit,

¹It is shown in Marsh's well known diagram; but there is no conclusive evidence of its presence on any specimen yet found.

and also a tiny remnant of the innermost or first digit. The proportions of the skull, the short neck and arched back and the limbs of moderate length, were very little horselike—recalling on the contrary, some modern carnivorous animals, especially the civets (*Viverridae*). The teeth were short-crowned and covered with low rounded knobs of enamel, suggesting those of monkeys and of pigs or other omnivorous animals, but not at all like the long-crowned complicated grinders of the horse.

Commencing with the *Hyracotherium*, twelve stages have been recognized from as many successive formations, showing the gradual evolution of the race into its modern form, and each stage is characteristic of its particular geological horizon. Some of the stages have been found in several parts of the world, but by far the most complete and best known series comes from the Tertiary Badlands of the western United States. Besides the main line of descent which led into the modern horses, asses and zebras, there were several collateral branches which have left no descendants. Of some stages all parts of the skeleton have been found; of others only the jaws, or jaws and feet, are known. We can mention only the more important stages.

1 and 2.¹ **Hyracotherium** and **Eohippus**. LOWER EOCENE. The *Hyracotherium* is the most primitive stage known, but only the skull has been found, so that it has not been determined exactly what the feet were like. The teeth display six rounded knobs or cusps on the upper molars and four on the lower ones, and these are just beginning to show signs of fusing into cross-crests. The premolar teeth have only one main cusp, except the third and fourth premolars (next the molars) in each jaw, which have two and three, respectively. The only specimens which have been found were in the London Clay or Lower Eocene of England and are preserved in the British Museum.

The *Eohippus* is much better known. It comes from the Lower Eocene of Wyoming and New Mexico, and is very like the *Hyracotherium*² except that in some species the molar teeth have the cusps more clearly fusing into cross-crests; the last premolar is beginning to look like one of the true molars. The fore foot of this animal has four complete toes. The hind foot has three complete toes and the splints of the first and fifth digits can still be detected in some species. A skeleton of *Eohippus* was found by Dr. J. L. Wortman in 1880 in the Wind River Badlands of



Fig. 4. *Eohippus*. Lower Eocene. Upper teeth, natural size. Short-crowned teeth, no cement, premolars simpler and smaller than molars

¹These numbers refer to the stages in the direct line of descent of the modern horse.

²It is doubtful whether it is a distinct genus.

Wyoming, and was described by Professor Cope in 1885. It was until recently the only skeleton known of a four-toed horse, and is well known to the scientific world. It was purchased by the trustees of the American Museum in 1894 and is now on exhibition.

A second skeleton found by the Museum expedition of 1910, is of a larger species, but not advanced in any other respect. It is mounted in a grazing attitude, and probably represents the general appearance of *Eohippus* more truly than the Cope skeleton. A third imperfect skeleton secured in 1911 is interesting as it shows the tiny splint bone of the inner digit of the hind foot, indicated by facets in other specimens but not actually found before. Crushed skulls, jaws and fragments of skeleton bones of thousands of individuals have been found in the Lower Eocene formations.

3. **Orohippus.** MIDDLE EOCENE. In this animal the splints of the first and fifth digits of the hind foot have disappeared, but there are still four complete and usable toes in the fore and three in the hind foot. The crests on the molars are a little clearer and the last premolar has become almost like the molars, while the next to the last premolar is partially molariform. A skeleton of *Orohippus*, discovered by Mr. Walter Granger of the Museum expedition of 1906, in the Bridger Badlands of southwestern Wyoming, is exhibited next to the *Eohippus* skeleton. It shows an animal of the size of a small dog and proportioned much like the breed known as the *whippet*.

The *Orohippus* was of about the same size and proportions as some of the pigmy antelopes or duikerboks (*Cephalophus*), which live in the open forests and brush country of East and South Africa, and have gained their name from the quickness with which they can dive or "duck" into the tall grass and jungle on the approach of danger.



Fig. 5. *Orohippus*. Middle Eocene. Upper teeth, natural size. Short-crowned teeth, no cement, fourth premolar like molars



Fig. 6. *Epihippus*. Upper Eocene. Upper teeth, natural size. Short-crowned teeth, no cement, third and fourth premolars like molars

4. **Epihippus.** UPPER EOCENE. Of this stage of the evolution of the horse only incomplete specimens have been found. The molar teeth have the once round cusps almost completely converted into crescents

and crests, while another tooth of the premolar series has become like the molars. The toes are still four in the fore foot and three in the hind

foot, but the central toe in each foot is becoming much larger than the side toes.

Palæotherium and *Plagiolophus* of the Upper Eocene of Europe form a side branch of the horse line. They were very abundant in Europe, but have not been found in the New World. One of these animals was thought by Professor Huxley to be a direct ancestor of the horse, but it is now considered to be merely a collateral relative. Some species of *Palæotherium* were of large size, equal to a tapir. They were first described in the year 1804 by the celebrated Baron Cuvier from remains found in the gypsum quarries of Montmartre, Paris.

THREE-TOED HORSES

5, 6 and 7. **Mesohippus** and **Miohippus**. OLIGOCENE. In this stage there are three toes on each foot, and a splint representing the fifth digit of the fore foot of the Eocene ancestors. The middle toe is now much larger than the side toes, which bear very little of the weight of the animal. Three of the premolars have now become entirely like the molar teeth, the crests on the crown are completely formed, and the outside crest in the upper molars has taken the shape of two crescents. In the Lower and Middle Oligocene are found several species of *Mesohippus* mostly of the size of a coyote, represented by two mounted skeletons, and various skulls, jaws and feet. In the Upper Oligocene occurs *Miohippus intermedius* as large as a sheep, of which a fine skeleton is exhibited in the pavilion case. Several other species of larger or smaller size are represented by skulls and jaws.

The series of skeletons in the pavilion case shows in a very striking way the steady increase in size from the Lower Eocene to the Upper Oligocene, and the reduction of the side toes with concentration of the weight upon the middle toe.

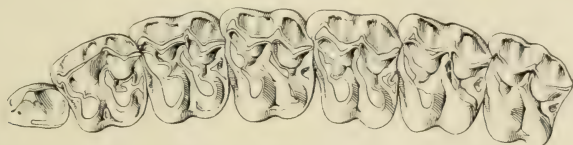


Fig. 7. *Mesohippus*. Middle Oligocene. Upper teeth, natural size. Short-crowned teeth, no cement, second, third and fourth premolars like molars

8a. **Anchitherium** and **Hypohippus**. MIOCENE. *Anchitherium* has been found only in Europe, and is still very incompletely known. It is much like *Mesohippus*, but is larger and has the crests of the teeth somewhat higher and more complete. *Hypohippus* is off the direct line of descent; its teeth are like those of *Anchitherium*, by which name it has

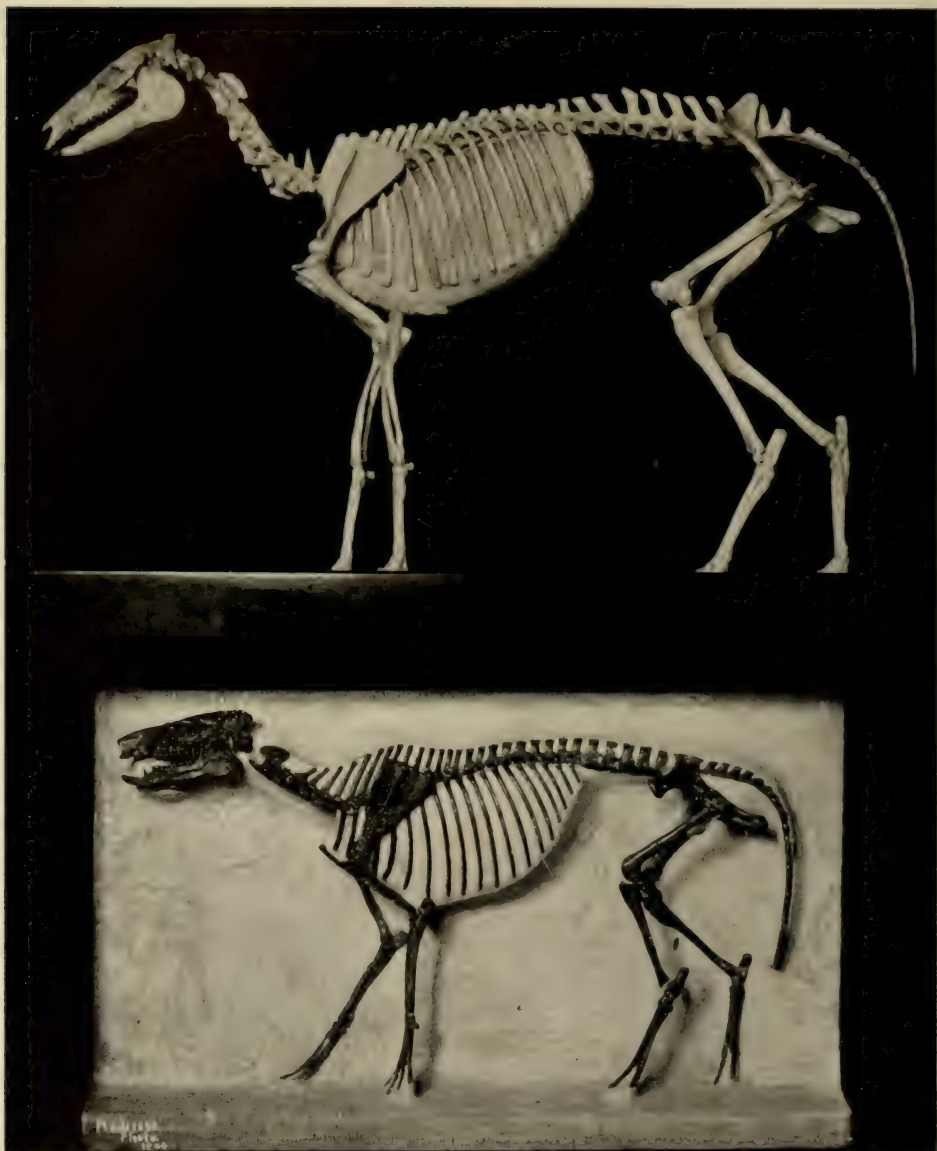
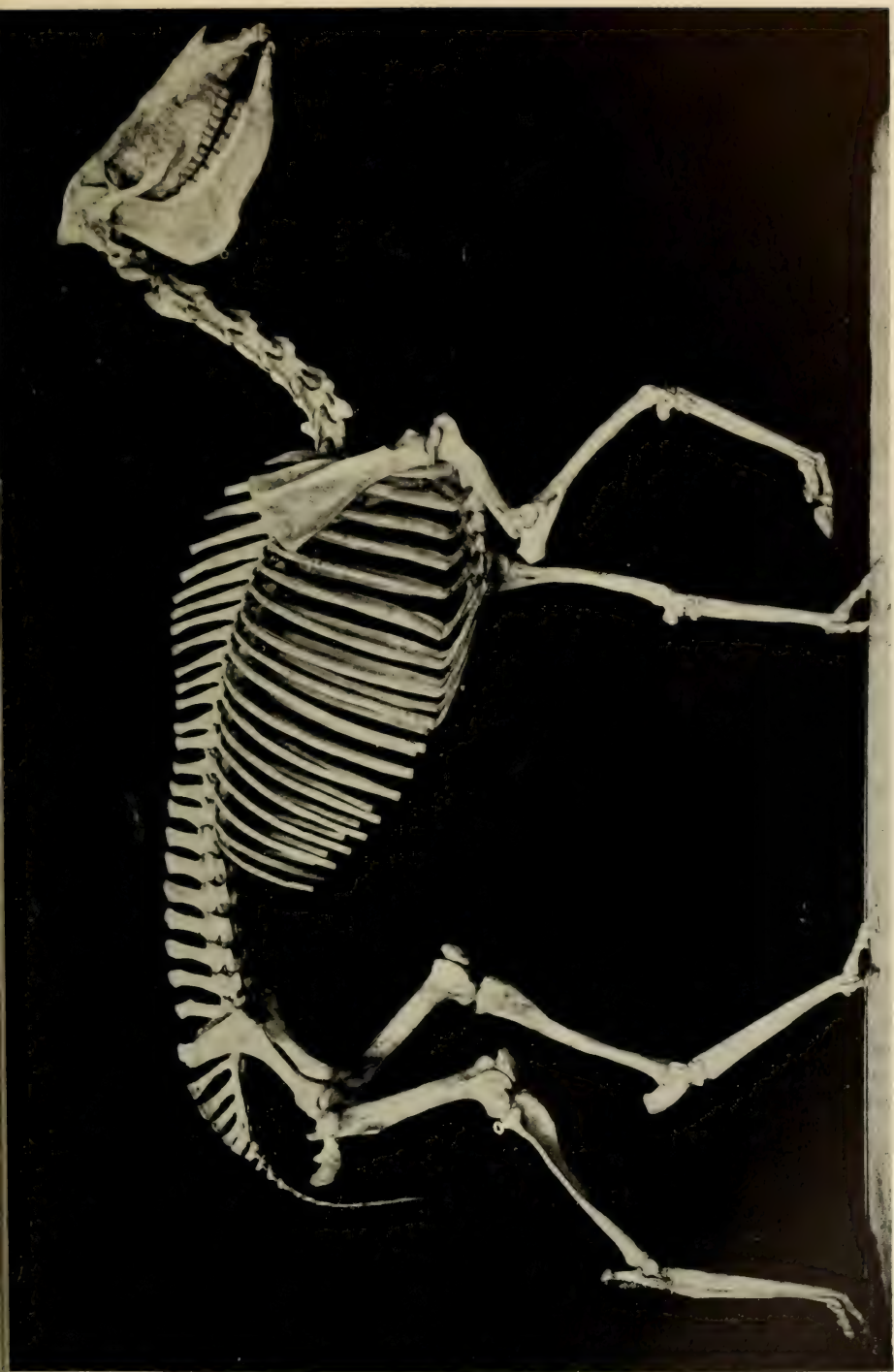


Fig. 8. Little three-toed horse (*Meshippus bairdi*) from the Middle Oligocene of South Dakota. American Museum No. 1492

Four-toed horse (*Eohippus venticolus*) from the Lower Eocene of Wyoming. American Museum No. 4832



After Osborn
1915

FIG. 9. SKELETON OF THREE-TOED DESERT HORSE (*Hipparion whitneyi*).
From the Upper Miocene of South Dakota. American Museum No. 9815

been generally called, but the animal was much larger, equalling a Shetland pony in size. A complete skeleton of the *Hypohippus* (shown in wall case) was found near Pawnee Buttes, Colorado, in 1901 by Mr. Barnum Brown, of the Whitney expedition.

Hypohippus first appears in the Middle Miocene, and survives along with more advanced stages of the three-toed horses. It is a larger and more heavily proportioned animal; the wide flat hoofs and strong side toes enabled it to tread on soft ground, and the teeth are fitted for browsing rather than grazing. Hence Professor Osborn considers it as adapted for a forest life, and has named it the "three-toed forest horse." The restoration illustrates this supposed habitat and adaptation.

8 and 9. **Parahippus.** MIOCENE. In *Parahippus* the tooth-crests are somewhat higher, and the transverse ridges on the upper molars are beginning to change shape so as to become a second pair of crescents inside the outer pair. In the valleys between the cross-crests and on the sides and base of the crown, a deposit of cement appears on the surface of the enamel. In some species there is a considerable amount, but usually it is a very thin coat. There is no cement on the milk teeth. The feet show a decided advance over the preceding stages, the side toes are very slender, and no longer touch the ground. The fifth digit of the fore foot is in some species a very short small splint, in others it is still further reduced to a little irregular nodule of bone. This stage first appears in the Lower Miocene, and several skulls and incomplete skeletons have recently been obtained from formations of this age. It survived however, although rare, as a contemporary of the later three-toed horses.

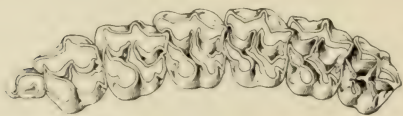


Fig. 10. *Parahippus*. Lower Miocene. Upper teeth, one-half natural size. Short-crowned teeth, traces of cement. The teeth are larger than in *Mesohippus* [the drawing is on a smaller scale], the crowns a little longer, and the inner "crests" begin to show the change to "crescents"

10. **Merychippus.** MIDDLE MIOCENE. This stage marks the transition between the older short-crowned teeth without cement, and the long-crowned heavily cemented teeth of the later stages. The permanent molars are intermediate in length of crown, and quite heavily cemented, but the milk molars are short-crowned and have little or

no cement; they are not easily distinguishable from those of *Parahippus*. The side toes are slender and no longer reach the ground; in some species they are almost reduced to splints. *Merychippus* is common in the Middle and later Miocene, and many skulls, jaws and incomplete skeletons are contained in our collections, some of which are placed on exhibi-

tion. These very perfect specimens show a vestige of the fifth digit in the fore foot still preserved as a tiny nodule of bone at the back of the wrist.

11. **Hipparion, Protohippus and Pliohippus.** UPPER MIOCENE AND PLIOCENE. These three closely related genera represent the latest stage of three-toed horses, before the side toes were reduced to splints. The teeth are long-crowned, both milk and permanent teeth being heavily cemented, and the side toes are extremely slender. They first appear in the Upper Miocene, probably directly descended from Middle Miocene species of *Merychippus*, and are best represented by the beautifully preserved skeleton of *Hipparion whitneyi* from Little White River,

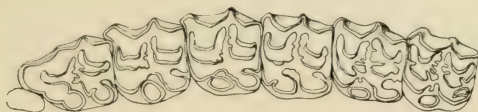


Fig. 11. *Merychippus*. Middle Miocene. Upper teeth, one-half natural size. Moderately long-crowned teeth, well cemented

South Dakota, found by Mr. H. F. Wells of the Whitney expedition of 1902. This species, except for the very large head, had the graceful and slender proportions of the antelopes, but in *Protohippus* and especially in *Pliohippus* the skeleton approached more nearly the stockier proportions of the modern horses. The *Hipparion whitneyi* is regarded by Professor Osborn as fitted to live in a semi-desert country, and in contrast to the *Hypohippus*, is called the "three-toed desert horse." The restoration depicts this adaptation and environment.

In this stage the crowns of the upper molars have become much longer, the two pairs of crescents on the upper molars are complete, with two half-separated cusps within the inner pair. And the valleys between the crests are completely filled with cement, so that with the wear of the teeth the edges of hard enamel are backed inside by dentine and outside by cement. In this way the surface of the tooth has a series of enamel ridges always projecting a little above the grinding surface, because the softer material on each side wears down into hollows, yet never breaking off, because they are braced so thoroughly on each side. This is a very efficient instrument for grinding hard grasses. The crowns of the teeth in these Miocene horses are by no means as long as in the modern horses; they must therefore have worn more slowly or worn out at an earlier age.

The feet in these genera have but one toe touching the ground. The side toes (second and fourth digits) are complete, but much more slender

than in the earlier stages and are apparently useless, as they cannot reach the ground. In some species they have almost disappeared.) The fore feet of these Upper Miocene horses still retain the tiny nodule of bone at the back of the "knee" (the joint that corresponds to the wrist of a man), which is the last remnant of the fifth digit possessed by their remote ancestors.

Hipparion is common in Europe and Asia as well as in North America, but *Protohippus* and *Pliohippus* are not found in the Old World.

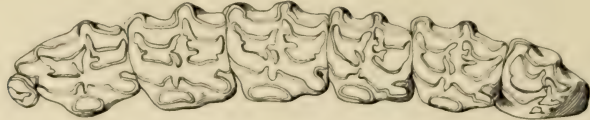


Fig. 12. *Hipparion*. Lower Pliocene. Upper teeth one-half natural size. Long-crowned teeth, heavily cemented

ONE-TOED HORSES

12. **Pliohippus.** PLIOCENE. In some species of *Pliohippus*, although not in all, the side toes are still further reduced to long slender splint-like bones which are enclosed within the skin, the little separate toes having disappeared. These are the first of the One-toed Horses. The splint is nearly as long as the cannon bone, much longer than it is in *Equus*. Two fine skeletons of *Pliohippus* in the Museum collections (*P. leidyanus*, adult, and *P. lullianus*, young) admirably illustrate this stage.¹ They are of somewhat later geologic age than the *Hipparion* skeleton, and nearer to the modern horse in size, proportions and various details of structure. Yet they are so much like other species of *Pliohippus* in which the side toes are still complete that both are placed in the same genus. *Pliohippus* is therefore transitional from the three-toed to the one-toed stage. It may be that some of the later species of *Hipparion* were also one-toed, but at present there is no proof of it.

13a. **Equus.** PLEISTOCENE and RECENT. In this stage, that of the modern horse, the side toes have entirely disappeared and are represented by moderately long splints on the fore and hind foot. No trace remains on the fore foot of the little nodule which in previous stages represented the fifth digit, while on the inner side of the wrist the "trapezium."

¹*Pliohippus* was described in 1874 by Professor Marsh, as a one-toed ancestor of the horse; but his specimens do not prove that the side toes were certainly absent. These two skeletons found in 1917 by H. J. Cook and 1916 by E. R. Troxell show this conclusively, and we are therefore able to distinguish them as a separate stage in the evolution of the horse. In previous editions of this guide, 1903, 1905, 1913, this stage was not distinguished, as conclusive proof from specimens had not been found.

always present in the earlier stages, but progressively smaller, is now generally absent entirely. The crowns of the teeth are much longer, and of the two half-separated inner columns on the upper molars, one has disappeared, the other has increased in size and changed in form. The skull has lengthened and the animal is much larger.

It is well represented among the fossil horses by the skeleton and skulls of *Equus scotti* already noticed and by skulls, jaws and teeth of other species from various localities.

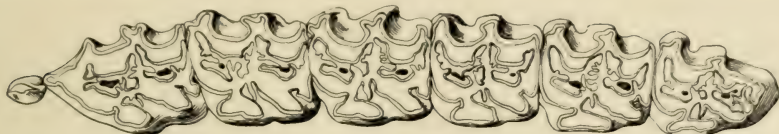


Fig. 13. *Equus*. Pleistocene. Upper teeth, one-half natural size. Very long-crowned teeth, heavily cemented

13b. **Hippidium, Onohippidium.** PLEISTOCENE. SOUTH AMERICA. The feet are like those of *Equus*, except that they are short and stout. The teeth are like those of *Pliohippus*, from which it is supposed to be descended. The skull is large and long with very long slender nasal bones. A cast of the skeleton of *Hippidium* presented by the Museo Nacional of Buenos Ayres, Argentine Republic, is on exhibition, also a skull cast of *Onohippidium*.

CONCLUSIONS

THESE are the principal stages in the evolution of the modern horse from the little four-toed *Eohippus*. Intermediate between them are numerous minor stages, the earlier species of each genus being more primitive, the later species more advanced. The series of upper molar teeth shown in Figs. 19-20 show no wide differences from one stage to the next. But between most of them several intermediate species are known. This gradual change is seen not merely in one or a few selected parts, but in every bone, every tooth, every portion of the skeleton. Elsewhere in the hall may be found similar although less complete series leading up from animals very close to *Eohippus* into the modern tapir and rhinoceros. The conclusion is unavoidable that horse, rhinoceros and tapir, three races widely different to-day, are derived through progressive changes from a common ancestral type. New *species* may have appeared suddenly, but the race in its broader lines is the product of gradual evolution, and diverse races may be traced back to a more ancient common stock.¹

¹Scientific criticisms of "Darwinism" are concerned with the way in which new species have appeared, whether by infinitesimal gradations or by finite "mutations," appreciable although usually small steps. The broader lines of evolution are not affected by these criticisms.

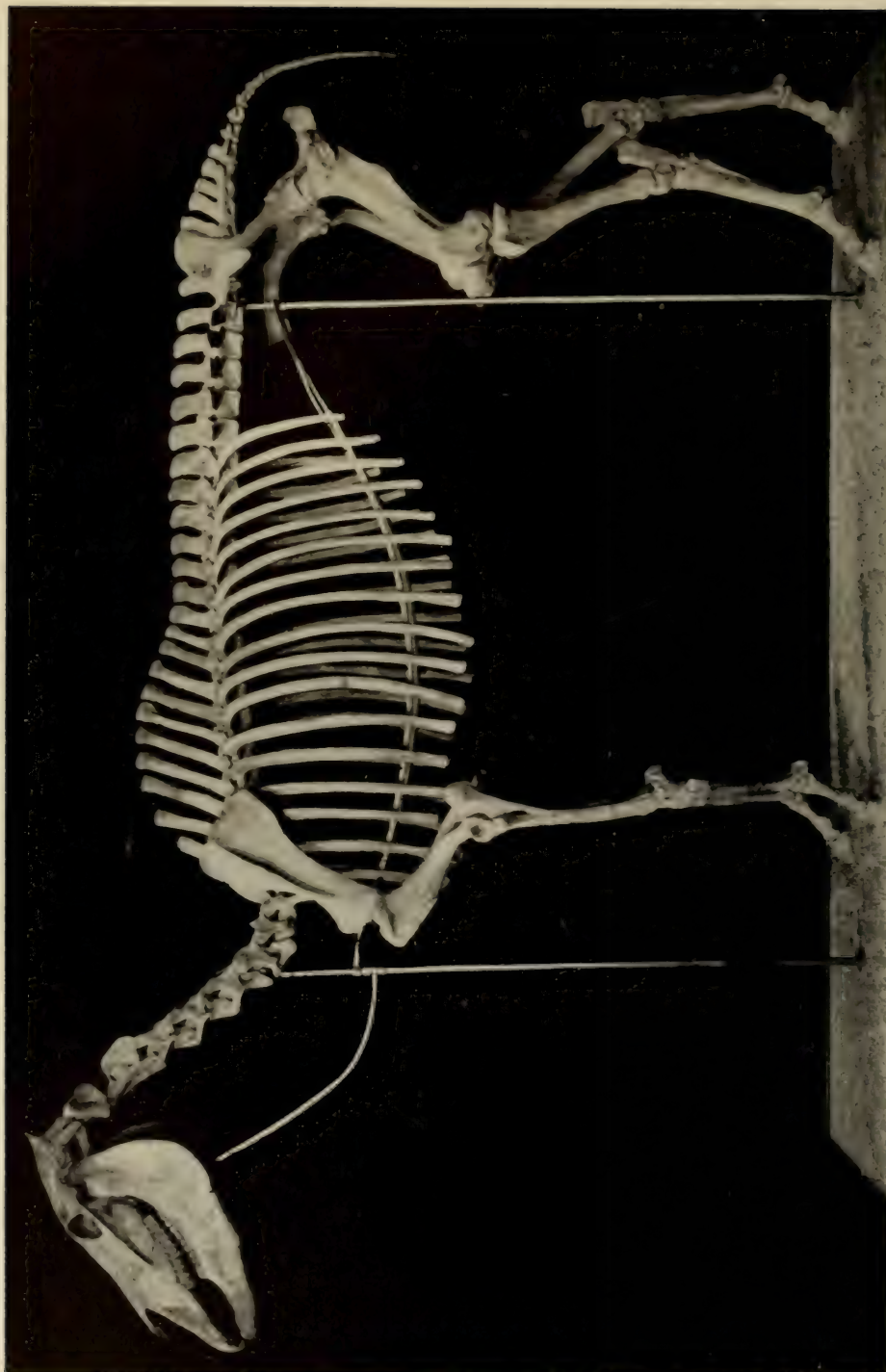


FIG. 14. SKELETON OF EXTINCT AMERICAN HORSE (*Equus scotti*)
From Lower Pleistocene of Texas. American Museum No. 10608

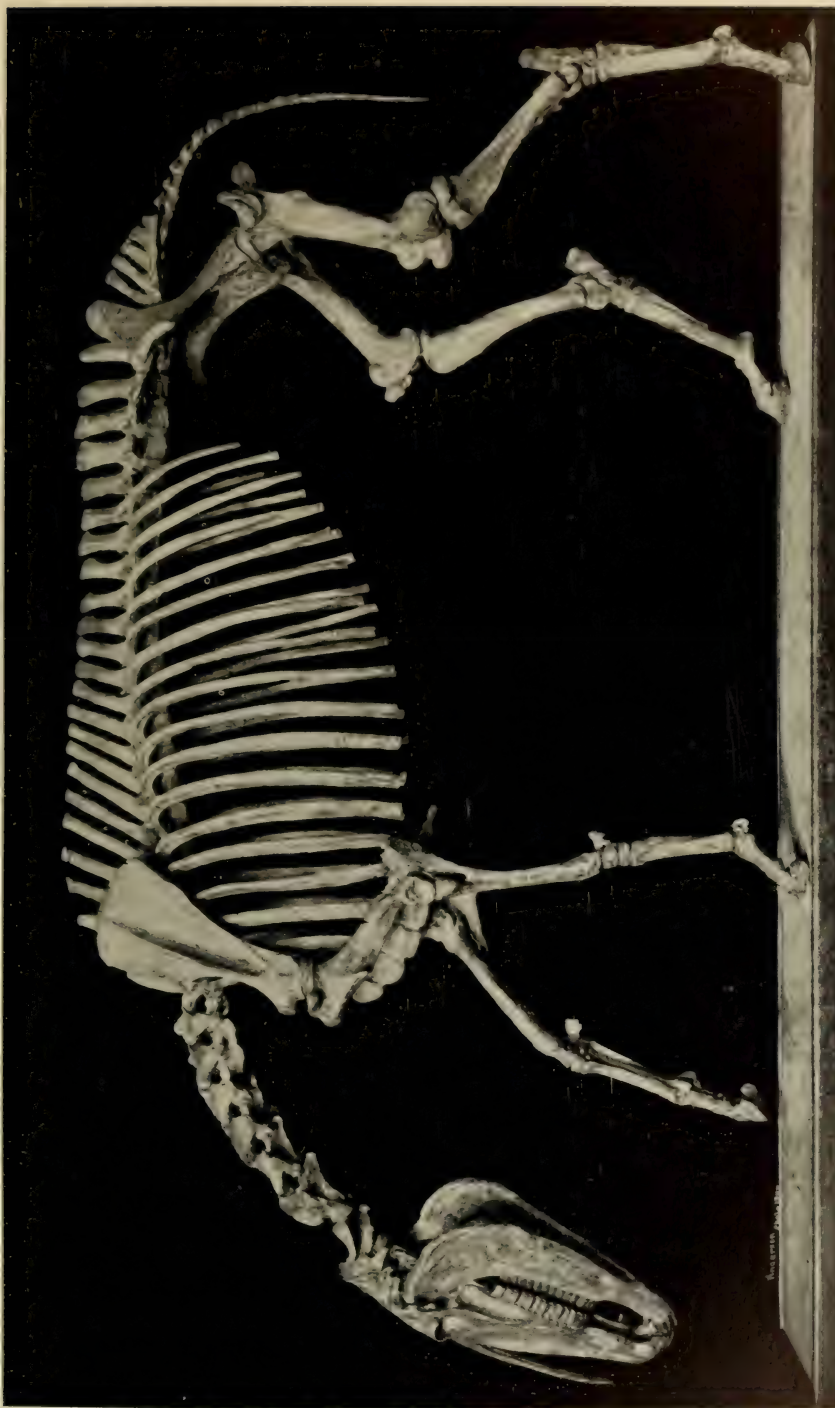


FIG. 15. SKELETON OF SHORT-LIMBED HORSE *Hippiidium*
From Pleistocene of Argentine Republic. From a cast in the American Museum

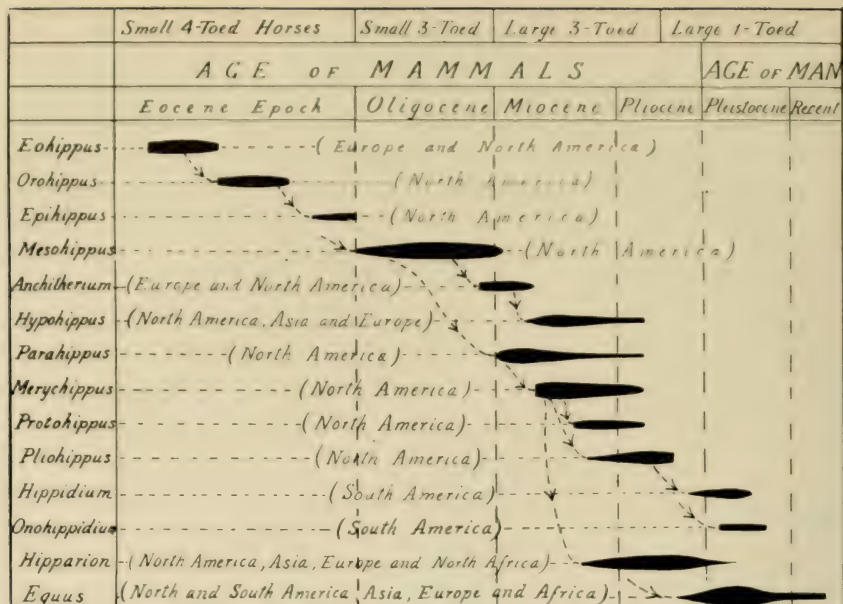


Fig. 16. Geological and geographical range of ancestors of the horse. The position and length of the heavy black lines show the occurrence and range of each genus in the successive geologic epochs, while the thickness of the lines indicates relative abundance. The dotted connecting lines with arrows indicate the genealogy

MEANING OF THE CHANGE IN FEET AND TEETH

ALONG with the disappearance of the side toes in the evolution of the horse there is a considerable increase in the proportionate length of the limbs, and especially of the lower part of the leg and foot. The surfaces of the joints, at first more or less of the ball-and-socket kind which allows free motion of the limb in all directions, become keeled and grooved like a pulley-wheel, permitting free motion forward and backward, but limiting the motion in all other directions and increasing considerably the strength of the joint. By this means the foot is made more efficient for locomotion over a smooth regular surface, but less so for traveling over very rough ground, and it becomes of little use for striking or grasping or the varied purposes for which the feet of polydaetyl animals are used.

The increased length in the lower leg and foot increases the length of the stride without decreasing its quickness. The heavy muscles of the leg are chiefly in the upper part, and to increase the length of the lower part changes the centre of gravity of the limb very little. Consequently the leg swings to and from the socket nearly as fast as before, since in an ordinary step the action of the leg is like that of a pendulum, and the

speed of the swing is regulated by the distance of the centre of gravity from the point of attachment, as that of a pendulum is by the height of the bob. To increase the length of lower leg and foot therefore gives the animal greater speed; but it puts an increased strain on the ankles and

toe-joints, and these must be strengthened correspondingly by converting them from ball-and-socket joints to "ginglymoid" or pulley joints.

Additional strength, likewise at the expense of flexibility, is obtained by the consolidation of the two bones of the forearm (ulna and radius) and of the leg (tibia and fibula) into one, the shaft of the smaller bone practically disappearing, while its ends become fused solidly to its larger neighbor.

The increase in length of limb renders it necessary for the grazing animal that the head and neck should

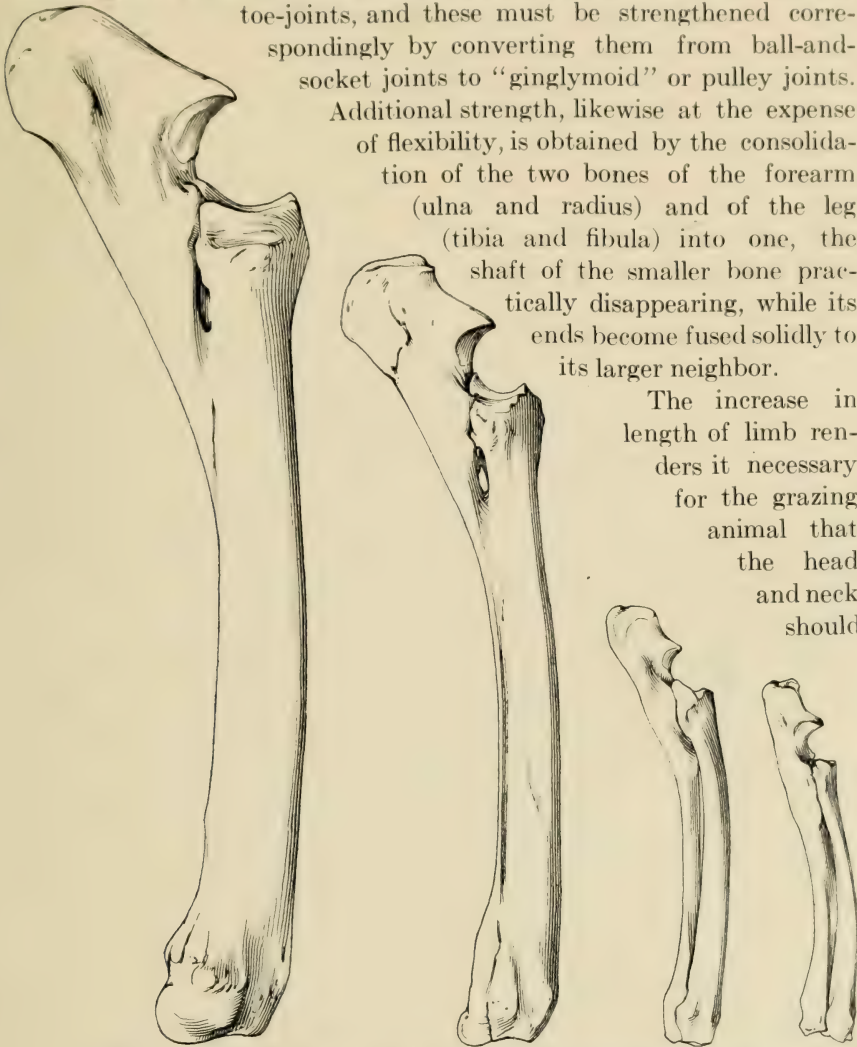


FIG. 17. EVOLUTION OF THE FORE LEG. PRINCIPAL STAGES

Equus, Merychippus, Mesohippus, Eohippus.

In the four-toed horses (*Eohippus*) the radius and ulna are separate and their shafts of about equal size. In the earlier three-toed horses (*Mesohippus*) the ulna is separate but its shaft considerably reduced. In the later three-toed horses (*Merychippus*) the ulna is partly consolidated with the radius and its shaft is reduced to a thin thread. In the one-toed horses (*Equus*) the ulna is more completely consolidated with the radius and its shaft has entirely disappeared

increase in length in order to enable the mouth to reach the ground. An example of these changes is the modern horse, in which we find the neck and head much elongated when compared with the little *Hyracotherium* and this elongation has taken place *pari passu* with the elongation of the legs. The reduction and disappearance of the side toes and the concentration of the step on the single central toe serve likewise to increase the speed over smooth ground. The soft yielding surface of the polydactyl (several-toed) foot is able to accommodate itself to a rough irregular surface, but on smooth ground the yielding

step entails a certain loss of speed. A somewhat similar case is seen in the pneumatic tire of a bicycle; a "soft" tire accommodates itself to a rough road and makes easier riding, but a "hard" tire is faster, especially on a smooth road. Similarly, the

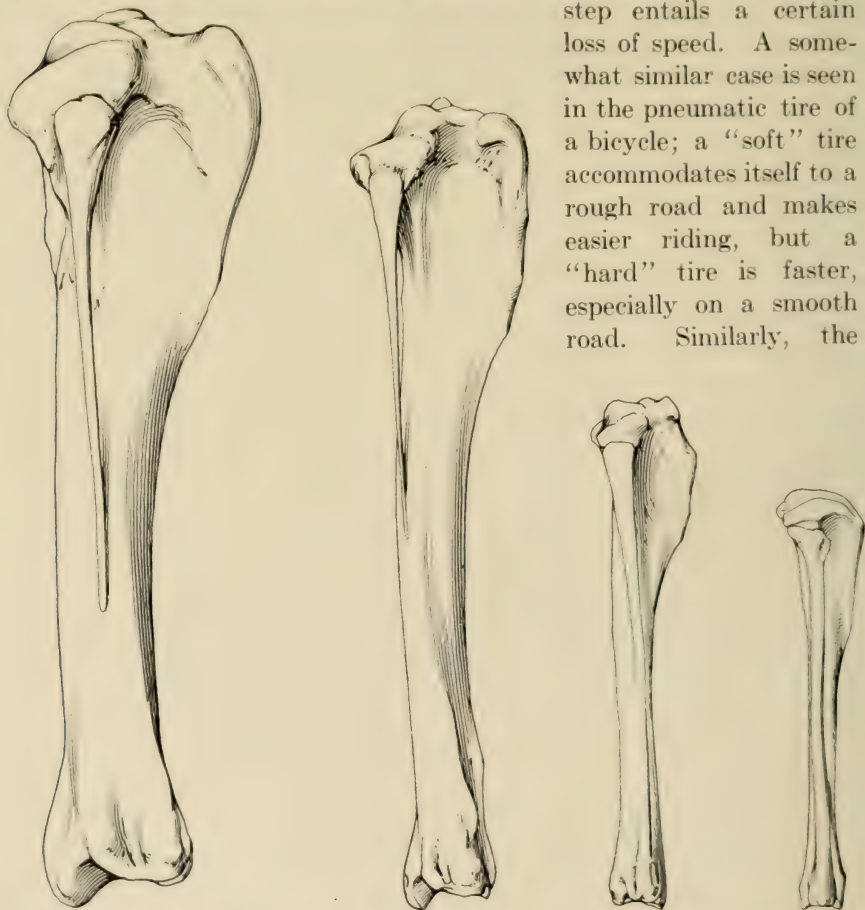
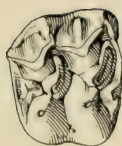


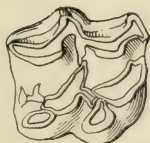
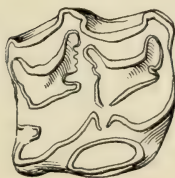
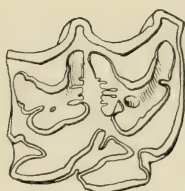
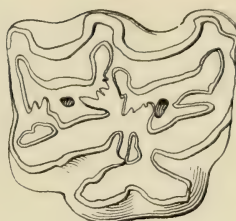
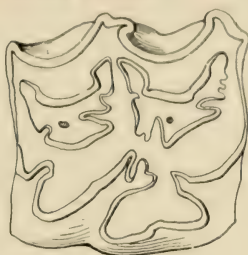
Fig. 18. EVOLUTION OF THE HIND LEG. PRINCIPAL STAGES

Equus, Merychippus, Mesohippus, Eohippus.

In the four-toed horses (*Eohippus*) the fibula is complete and separate from the tibia. In the earlier three-toed horse (*Mesohippus*) it is very slender, and fused with the tibia from about the middle of the shaft down. In the later three-toed horses (*Merychippus*) the shaft of the fibula is incomplete and both ends are fused with the tibia. In the one-toed horses (*Equus*) the lower end is more thoroughly united so as to be indistinguishable from the tibia.



**Fig. 20. EVOLUTION OF THE TEETH.
LATER STAGES.** Second Upper Molar



(Read up). (8) *Merychippus*, Middle Miocene; (9) *Hipparion*, Upper Miocene; (10) *Equus stenonis*, Pliocene; (11) *Equus complicatus*, Pleistocene; (12) *Equus caballus*, the modern horse

Fig. 19. EVOLUTION OF THE TEETH. EARLIER STAGES. Second

Upper Molar (Read up). (1) *Eohippus*, Lower Eocene; (2) *Orohippus*, Middle Eocene; (3) *Epihippus*, Upper Eocene; (4) *Mesohippus montanensis*, Lower Oligocene; (5) *Mesohippus bairdi*, Middle Oligocene; (6) *Miohippus*, Upper Oligocene; (7) *Parahippus*, Lower Miocene

hard, firm step from the single toe allows of more speed over a smooth surface, although it compels the animal to pick its way slowly and with care on rough, irregular ground.

The change in the character of the teeth from brachydont or short-crowned to hypsodont or long-crowned, enables the animal to subsist on the hard, comparatively innutritious grasses of the dry plains, which require much more thorough mastication before they can be of any use as food than do the softer green foods of the swamps and forests.

All these changes in the evolution of the horse are adaptations to a life in a region of level, smooth and open grassy plains such as are now its natural habitat. At first the race was better fitted for a forest life, but it has become more and more completely adapted to live and compete with its enemies or rivals under the conditions which prevail in the high dry plains of the interior of the great continents. The great increase in size, which has occurred in almost all races of animals whose evolution we can trace, is dependent on abundance of food. A large animal, as may be shown on ordinary principles of mechanics, requires more food in proportion to its size than does a small one, in order to keep up a proper amount of activity. On the other hand a large animal is better able than a small one to defend itself against its enemies and rivals. Consequently as long as food is abundant, the larger animals have the advantage over their smaller brethren, and by the laws of natural selection the race tends to become continually larger until a limit is reached, when sufficient food becomes difficult to obtain, the animal being compelled to devote nearly all its time to getting enough to eat.



After Osborn

FIG. 21. EVOLUTION OF THE HIND FOOT OF THE HORSE

Side views of six stages, *Eohippus*, *Mesohippus*, *Miohippus*, *Merychippus*, *Hipparion*, *Equus*

CAUSE OF THE EVOLUTION

THE evolution of the horse, adapting it to live on the dry plains, probably went hand in hand with the evolution of the plains themselves. At the commencement of the Age of Mammals the western part of the North American continent was by no means as high above sea level as it now is. Great parts of it had but recently emerged, and the Gulf of Mexico still stretched far up the valley of the Mississippi. The climate at that time was probably very moist, warm and tropical, as is shown by the tropical forest trees, found fossil even as far as Greenland. Such a climate, with the low elevation of the land, would favor the growth of dense forests all over the country, and to such conditions of life the animals of the beginning of the mammalian period must have been adapted. During the Tertiary the continent was steadily rising above the ocean level, and at the same time other influences were at work to make the climate continually colder and drier. The coming on of a cold, dry climate restricted and thinned the forests and caused the appearance and extension of open, grassy plains. The ancient forest inhabitants were forced either to retreat and disappear with the forests, or to adapt themselves to the new conditions of life. The ancestors of the horse, following the latter course, changed with the changing conditions, and the race became finally as we see it to-day, one of the most highly specialized of animals in its adaptation to its peculiar environment. At the end of the Age of Mammals the continents stood at a higher elevation than at present, and there was a broad land connection between Asia and North America, as well as those now existing. At this time the horse became cosmopolitan, and inhabited the plains of all the great continents, excepting Australia.

It is a question whether the direct ancestry of the modern horse is to be searched for in western America or in the little known interior plains of eastern Asia. It is also unknown why the various species which inhabited North and South America and Europe during the early part of the Age of Man should have become extinct, while those of Asia (horse and wild ass) and of Africa (wild ass and zebra) still survive. Man, since his appearance, has played an important part in the extermination of the larger animals; but there is nothing to show how far he is responsible for the disappearance of the native American species of horse.

PARALLEL EVOLUTION IN OTHER RACES

It is interesting to observe that while the evolution of the horse was progressing during the Tertiary period in North America another group of hoofed animals, the Litopterna, now extinct, in South America evolved a race adapted to the broad plains of Argentina and

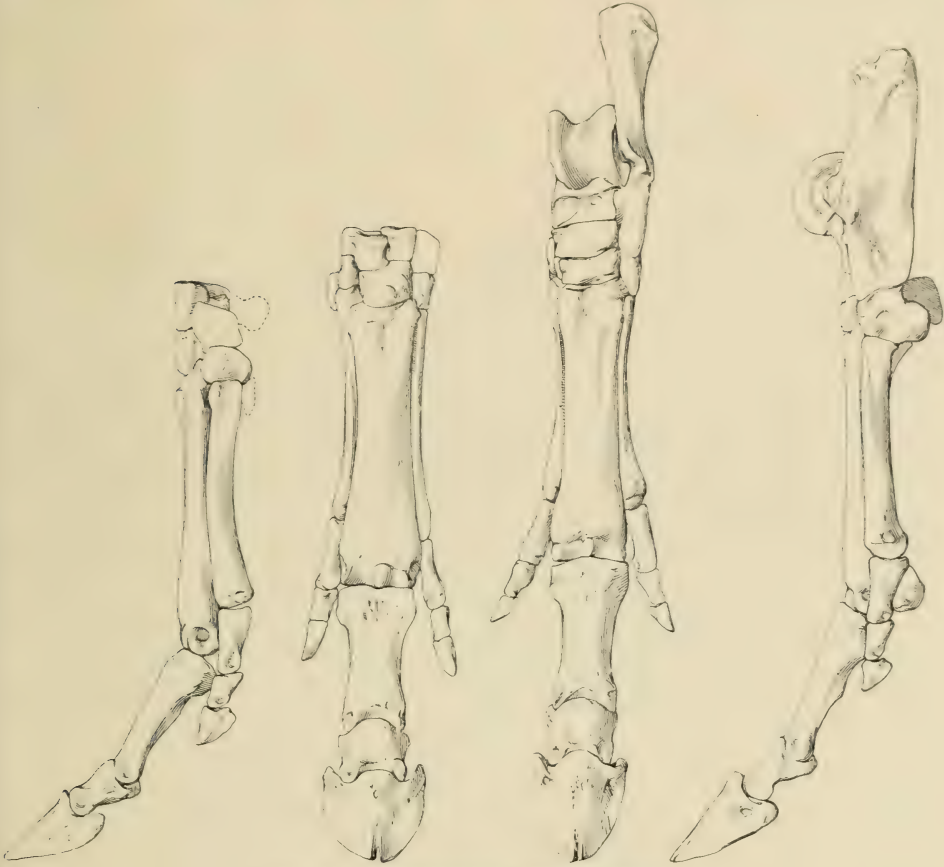


FIG. 22. THREE-TOED PSEUDO-HORSE

Fore and hind feet, one-half natural size. *Diadiaphorus* of the Miocene of South America, although so closely like the three-toed horses in the feet, has a wholly different skull and teeth, and belongs to a different order, the Litopterna, peculiar to South America and now extinct. From specimens in the American Museum

Patagonia and singularly like the horse in many ways. These animals likewise lost the lateral toes one after another, and concentrated the step on the central toe; they also changed the form of the joint-surfaces from ball-and-socket to pulley-wheel joints; they also lengthened the limbs and the neck; and they also lengthened the teeth, and complicated their pattern. Unlike the true horse, they did not form cement on the tooth, so that it was by no means so efficient a grinder. This group of animals native to South America became totally extinct, and were succeeded by the horses, immigrants from North America, which in their turn became extinct before the appearance of civilized man.

Many of the contemporaries of the horse in the northern hemisphere were likewise lengthening the limbs, lightening and strengthening



FIG. 23. ONE-TOED PSEUDO-HORSE

Fore and hind feet, one-half natural size. The *Thoatherium* has gone even further than the modern horse in reducing the side toes to tiny rudiments instead of splints. The skull and teeth show the animal to be closely related to *Diadiaphorus* (Fig. 22) and widely different from true horses. *Thoatherium* was a little larger than a fox terrier and lived in South America during the Miocene Epoch. From specimens in the Princeton Museum and the American Museum of Natural History

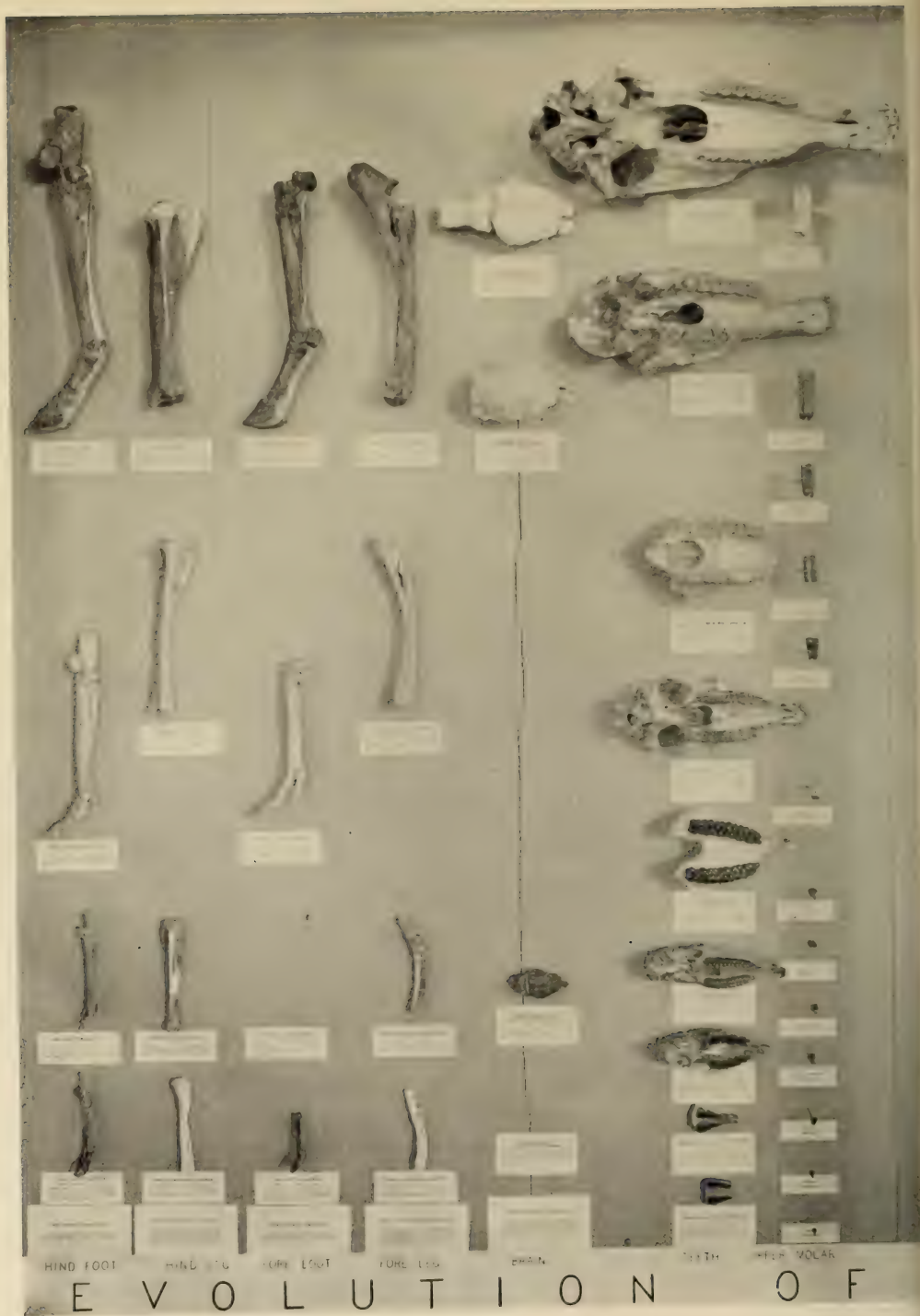
the feet, elongating the tooth-crowns to adapt themselves to the changing conditions around them, although none paralleled the horse evolution quite so closely as did the pseudo-horses of South America. But the camels in America, the deer, antelope, sheep and cattle in the Old World, progressed on much the same lines of evolution, although their adaptation was not to just the same conditions of life.

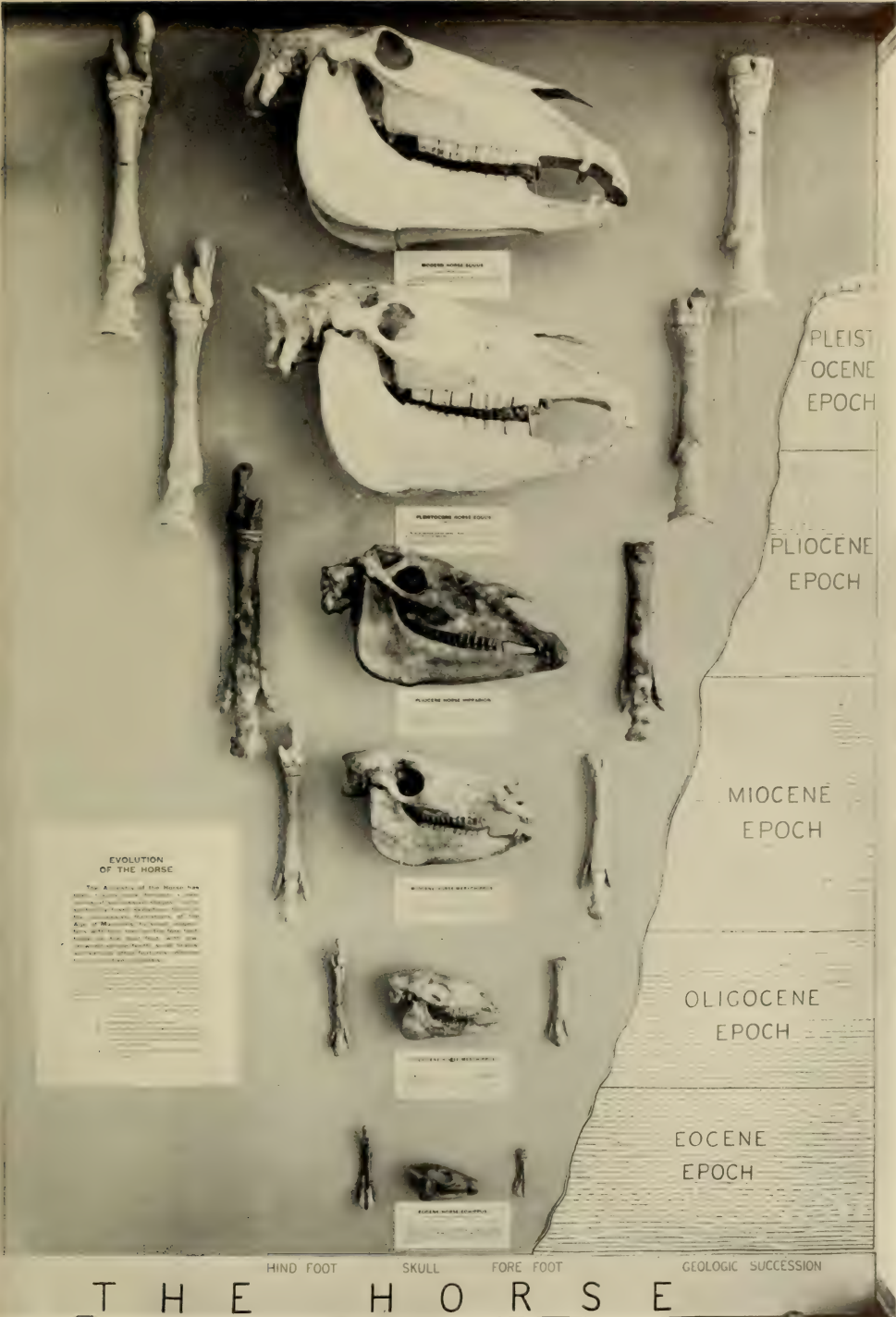
PRINCIPAL STAGES IN THE EVOLUTION OF THE HORSE.

SYNOPTIC PANEL

On the right hand at the entrance to the Horse Alcove is a double panel (pages 36 and 37) showing the chief stages in its evolution. On the right-hand panel is the series of skulls, fore feet and hind feet, each stage set opposite the geological epoch during which it lived. Thus all horses found as fossils in the rocks of the Eocene Epoch are Four-toed Horses; all from the Oligocene are small Three-toed Horses with short-crowned teeth, and so on.

On the left-hand panel is a corresponding series of palates to show the gradual change in pattern of the upper teeth, and conversion of the premolars into 'molariform' grinders; and a series of single teeth to show the progressive lengthening of the crown. The change in the brain, the fore leg and hind leg are also shown in this panel, and side views of the fore and hind foot show more clearly the stages in reduction of the side toes.





EVOLUTION OF THE HORSE

The Evolution of the Horse has been a subject of much interest and study. The horse is a member of the family Equidae, which is part of the order Artiodactyla. The earliest known horse, Hyracotherium, lived about 50 million years ago. It was a small, four-toed animal that ate soft-leafed plants. Over time, horses evolved into the large, single-toed animals we know today. This evolution was driven by changes in their environment, particularly the spread of grasslands. As horses adapted to these new environments, their teeth became more specialized for eating hard grass, and their legs became stronger for running long distances.

PLEISTOCENE EPOCH

PLIOCENE EPOCH

MIOCENE EPOCH

OLIGOCENE EPOCH

EOCENE EPOCH

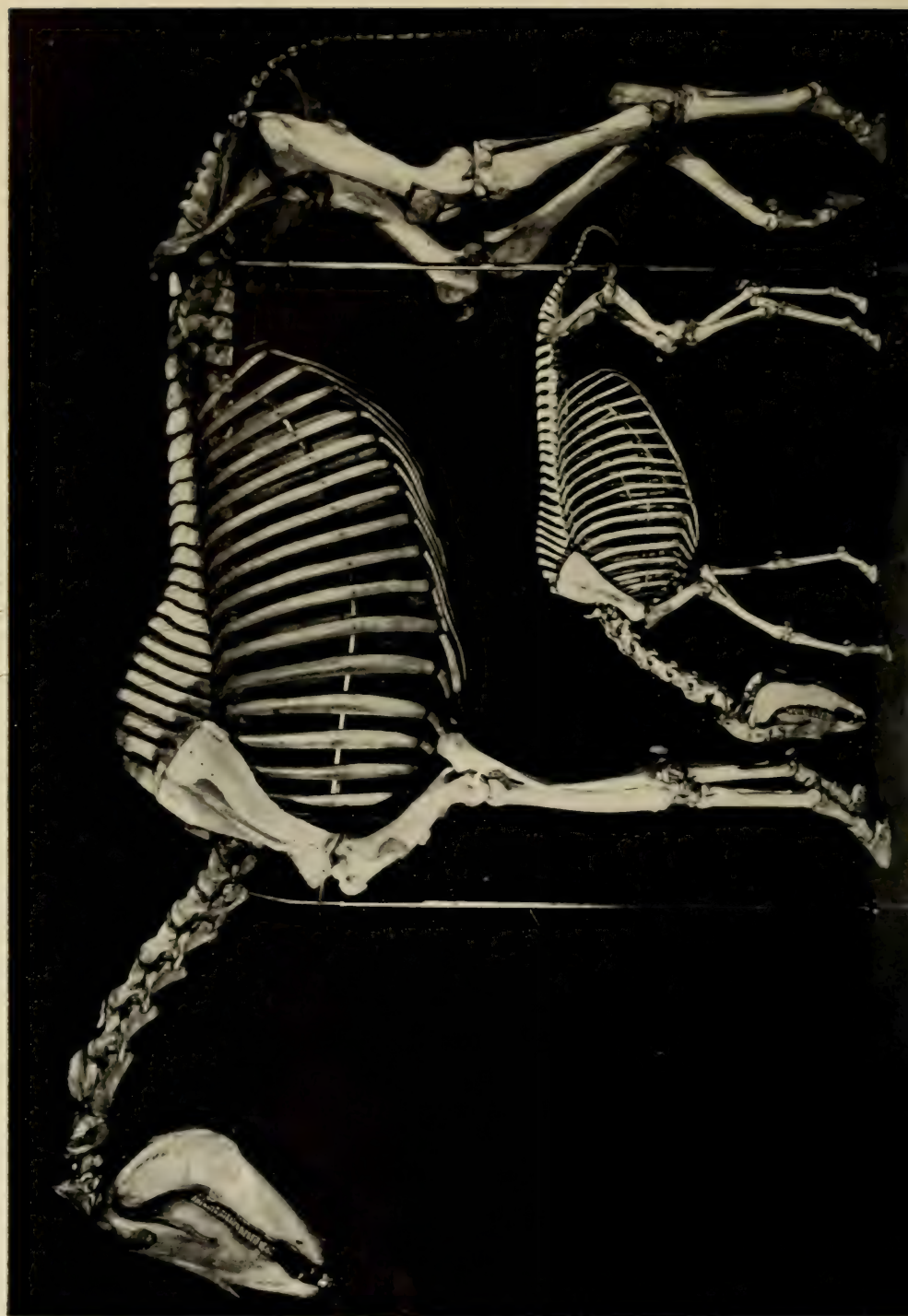
HIND FOOT

SKULL

FORE FOOT

GEOLOGIC SUCCESSION

THE HORSE



Part II. THE HORSE UNDER DOMESTICATION

ITS ORIGIN AND THE STRUCTURE AND GROWTH OF THE TEETH

By S. H. Chubb

WHEN animals are living under perfectly natural conditions, their physical structure is slowly modified by climate, topography of habitats and food supply as well as by many other forces. In the struggle for self-preservation among the competitors by which they are surrounded, they develop weapons of defence, or acquire speed mechanism or other means of escape. Thus what we may call natural, as opposed to artificial evolution, is controlled by a great variety of forces, while in a condition of domestication we have development directed in certain lines by man's intelligence.

ORIGIN OF THE DOMESTIC HORSE

IN the light of researches made by Professors Ridgeway, Osborn and Ewart, there seems to be little doubt that the domestic horse has been derived from several wild types which have since become extinct as wild species. Of two at least we may be reasonably sure: one of Europe or northwestern Asia, which has been called the Norseman's horse; the other from northern Africa, which Professor Ridgeway has called *Equus libycus*.

There is abundant evidence to prove that in the late Quaternary, during and after the Glacial Period, but nevertheless many thousands of years ago, prehistoric man chased and killed wild horses, using their flesh for food and possibly their skins for raiment. This period was followed by a second, during which wild horses were captured, broken to rude harness and driven. The rearing action of the horse skeleton in the group on exhibition in the Museum (Frontispiece) is designed to express unwilling subjection, and the position of the man, as if holding a bridle, intellectual control. The period of domestication passed insensibly into a third, that of artificial development, during which the horse was modified, and is still being modified in various directions.

Under man's protection and management, changes are brought about in domestic animals with considerable control and much more rapidly than under perfectly natural conditions. Through training and careful selection in breeding, speed has been greatly increased in the race horse, weight and strength have been developed in the draft horse, while the Shetland pony has been reduced to a most diminutive size.

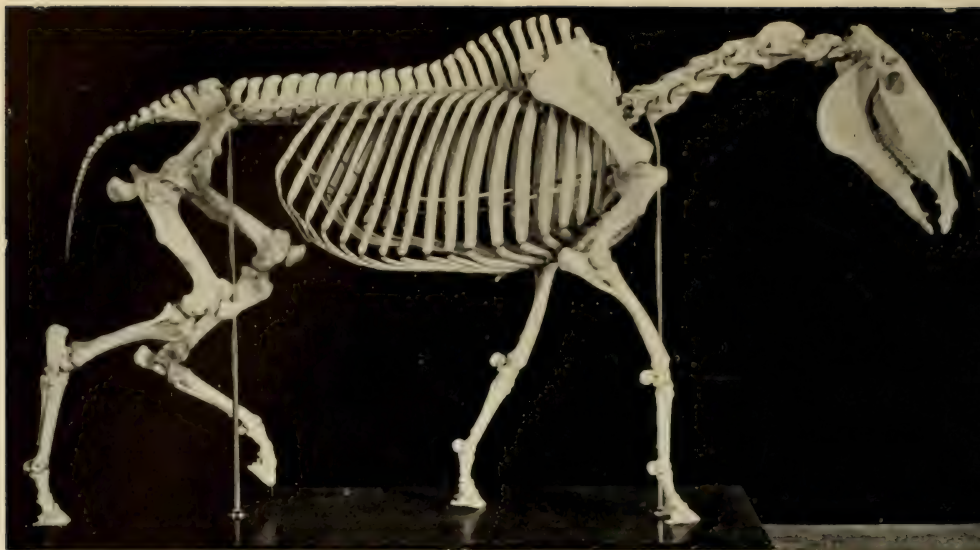


Fig. 26. The draft horse pulling a heavy load. Gift of the late William C. Whitney. The subject from which the skeleton was prepared was presented by Mr. George Ehret

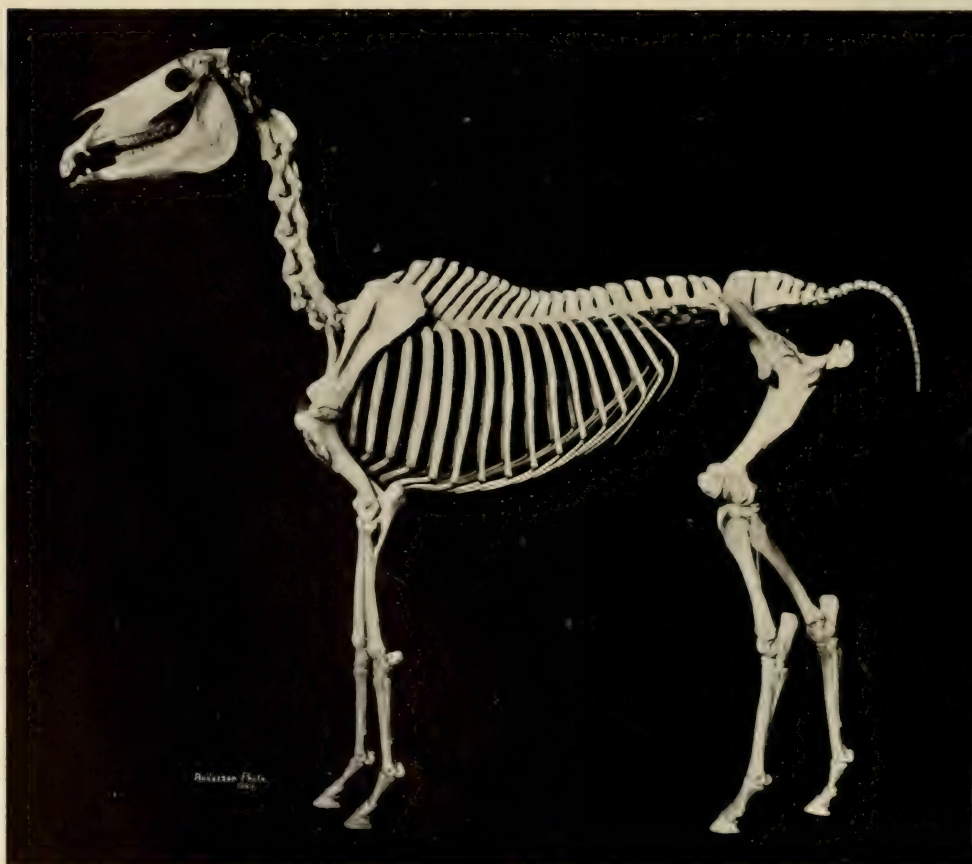


Fig. 27. Arabian stallion "Nimr." Mounted in the position of watching a herd. Subject presented by Mr. Randolph Huntington

The intimate relations which have thus existed between the horse and man have influenced both, and it is generally acknowledged by students of mankind that the subjugation of the horse and his adoption, both as a means of transportation and as an aid in agriculture, have been factors of the greatest importance in the later development of the human race.

COMPARISON OF THE SKELETON OF HORSE AND MAN

WHILE considering these two skeletons (Frontispiece), it will be worth while to look for a moment into their structure. They are so placed as to facilitate comparison. The one representing a typical or average type of horse, the other a man of about six feet in height and proportionately heavy. The limbs of the horse, moving only forward and backward, have much less freedom of motion than have those of man. Note the ball-and-socket joint of man at the shoulder and hip, the rotary motion of the forearm and the flexibility at the wrist and ankle, and compare with the restricted movement at the shoulder of the horse, the hingelike joint at the elbow, and the limited movement at the wrist (knee) and ankle (hock). The most pronounced differences however, are found in the head and feet. Compare the skull of man, which has an enormously developed brain and reduced facial portion, with that of the horse which has a comparatively small brain, the face, mouth, and teeth monopolizing almost the whole skull. The feet, instead of having five toes as in man, are reduced to a single digit¹ and they are very much elongated as a speed specialization. And yet a careful study will reveal a most striking similarity between the two subjects in general structure, the differences being simply modifications of a common plan.

THE DRAFT HORSE

THE Norseman's horse of Europe seems to have been an animal with large head, convex forehead and rough coat, of rather clumsy appearance, and of little speed. It may have been a near relative of the Przewalsky horse which still lives as a wild species in northwestern Mongolia, the only true wild horse known at the present time. Among other evidences of this prehistoric type, are the many sketches found in the south of France and elsewhere, made by the very primitive cave-dwellers, which seem clearly to depict this type of horse, and it is no doubt this strain which predominates in our heavy draft horse of to-day although of course this horse has been greatly increased in size and strength by long and careful breeding.

¹See page 22.

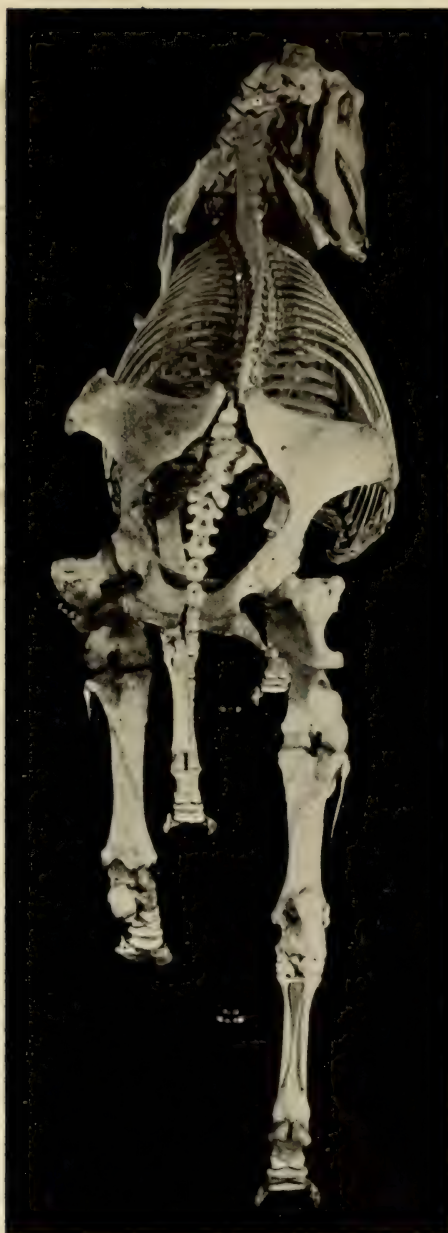


Fig. 28. The draft horse. Rear view showing action of pelvis and backbone

An attempt has been made to express the strength acquired in this breed in the mounted skeleton of the draft horse (Fig. 26). This skeleton has been so mounted as to show the action of the bones when the animal is drawing a heavy load. We must imagine that the shoulders rest against a collar upon which the horse is exerting its energy. Note that the head and body are lowered, the hind legs are doing the greater amount of work, the fore legs acting as supports, though a portion of the weight of the body has been thrown against the collar. From the rear view (Fig. 28) note that the right hip joint is much nearer the median line than is the left. The joint is also lower, and indeed, the entire right side of the pelvis has been lowered and thrown well to the left, so that when at the moment of greatest strain the right leg is extended, the pressure upon the anterior part of the body, and thence upon the collar, is applied in a line which coincides with the main axis of the body. At the next moment the left leg is supposed to be exerted, the right is released, the pelvis then swings to the right, the curve in the backbone becomes reversed and the pressure is again applied (this time from the left) along the main axis of the body as before; and so on from step to step.

DEVELOPMENT OF GREAT SIZE IN THE DRAFT HORSE

THE skeleton of a very large draft horse is exhibited to show the extreme development of size in this breed. It has been photographed with the skeleton of a Shetland pony to show two extremes in domestic horses (Fig. 25). The following is a table of measurements of the two specimens.

	GIANT DRAFT HORSE	SHETLAND PONY
Height at shoulders.....	6 ft. 1 in. ($18\frac{1}{4}$ hands)	2 ft. $9\frac{3}{8}$ in. ($8\frac{1}{3}$ hands)
Weight in life.....	2370 lbs.	170 lbs.
Bulk of humerus.....	$118\frac{3}{4}$ cu. in.	$9\frac{1}{2}$ cu. in.
Bulk of femur.....	188 cu. in.	$13\frac{1}{2}$ cu. in.

The pose chosen for the mounting of this specimen is one of inaction, designed to express quiet restfulness, in contrast to the running action of the race horse, to be mentioned later. It shows also a habit peculiar to horses, that of alternately resting the hind legs. Almost the entire weight of the hind quarters is supported on the extended left leg, while the right hind leg rests in a more flexed position and hangs perfectly lax. The pelvis also seems to hang, as it were, from the left hip joint, tilting very much to the right and slightly twisting the vertebral column.

A peculiar function of the patella (kneecap) in the horse is shown in the left knee joint or stifle. While the limb is extended and supports the animal's weight, the patella rests on a projecting articulation of the femur, so that the knee is locked in an extended position by a very strong ligament which holds the patella at a fixed distance from the tibia below, thus sustaining the weight required of it with comparatively little muscular exertion.

An abnormal peculiarity of this specimen is a pair of supernumerary molar teeth, which appear at the posterior end of the upper set. Having no opposing teeth in the lower jaw upon which to wear, they have protruded down into the gum and must have caused the animal considerable discomfort.

THE SHETLAND PONY

It is highly probable that the Shetland pony is derived from practically the same wild stock as the very much larger draft horse, but has been reduced in size by adverse conditions to which it was subjected in the cold and barren Shetland Islands with their limited area, and also by having been systematically bred for the smallest possible size.

Figure 25 shows the skeleton of an exceptionally small pony which was secured through the Whitney fund. This pony was bred in Scotland and obtained through the kindness of Professor J. C. Ewart of the University of Edinburgh. The skeleton represents the grazing action. It

will be seen that the downward reach of the head and the slow, lax step modify the position of almost every bone in the body.

The vertebral column is considerably arched in the dorsal region, thus assisting in the downward curve of the neck and at the same time tilting the angle of the pelvis a few degrees toward the perpendicular, increasing the length of the hind limbs and tilting the body toward the head. The head being turned well to the right, there is a very slight curve toward the left in the anterior portion of the dorsal vertebræ, and a slight curve to the right in the lumbar vertebræ owing to the backward position of the right hind foot.

The weight of the body falls on the right front and the left hind foot, bringing them both very near the median line, and also modifying the position of the scapula and elevating the left side of the pelvis. A little below the knee a very small hairlike bone may be seen, which represents the shaft of the almost extinct fibula, a bone which was well developed in the ancestors of the horse.

THE ARABIAN HORSE

OF all the many types of horses probably the one most universally admired and loved is the Arabian, with its marvelous grace and beauty, great intelligence, perfection of anatomical mechanism, fleetness and endurance. The question may well be asked, whence comes this superiority?

The great fondness and care with which the Arabs have bred their horses for many hundreds of years have undoubtedly done much for the elevation of the stock; but more than this it is shown almost conclusively that the Arab was blessed with a wonderfully fine natural species on which to exercise his care. On this point Professor William Ridgeway of Cambridge University, has given us an immense mass of most convincing evidence.¹

There are many reasons, traditional and historical, as well as zoölogical, for believing that the Arabian horse, or as Professor Ridgeway has called it, the Libyan horse, is in origin entirely separate from the very much inferior northern or Norseman's horse, and that its native home was not in Arabia but northern Africa, where it was domesticated by the ancient Libyans, in all probability as early as 2000 B. C.

The Egyptians also knew full well the value of domestic horses. "Egypt was, in fact, famous for its breed of horses which were not less excellent than numerous, and we find that they were even exported to other countries, Judea, Syria, and to the Kings of the Hittites."² It is

¹RIDGEWAY, WILLIAM. *Origin and Influence of the Thoroughbred Horse*. Cambridge: Univ. Press, 1905.

²WILKINSON, I. G. *Ancient Egyptians*

also clear, from Egyptian art, that these horses were of the North African, or as we would say to-day, Arabian type. It has been the constant infusion of this Libyan blood which has tended to improve our commoner horses for these many centuries.

The skeleton of "Nimr" (See Fig. 27, p. 40), a pure-blooded Arabian stallion, has been mounted to show some of the conspicuous characteristics of this species, which are as follows:

1. Head and tail carried high when the animal is animated;
2. Skull short, but broad between the eye sockets;
3. Eye sockets high and prominent, giving the eyes a wide range of vision;
4. Facial profile, or forehead, concave;
5. Muzzle slender, but jaw deep and wide-set above the throat;
6. Round thorax, well "ribbed up" and short back with only five ribless, or lumbar vertebræ;
7. Horizontally placed pelvis (a speed character) and very high tail region, few tail vertebræ;
8. A complete shaft of the ulna, or small bone of the forearm;
9. Long and slender cannon bones and long sloping pasterns.¹

"Nimr" was sired by the desert-bred Arabian "Kismet," famous for an unbroken series of victories as a race horse in India. After his death at Oyster Bay, Long Island, in 1904, the subject was presented to the Museum by the owner, Mr. Randolph Huntington.

THE RACE HORSE

AS for the earliest domestication of the horse in Britain, where the race horse or thoroughbred has since been developed, no definite statement can be made. We read that horsemen in large numbers opposed the landing of the Romans, and also that in 631 A. D. the English first began to saddle their horses. Again we find mention of "running" horses in the ninth century. But it is not until about 1689, when the famous "Byerley Turk" was brought to England, that we learn anything definite concerning the origin of the present English stock, though horses of undoubted North African blood had been imported from Turkey a century or more earlier.

The Darley Arabian, bred in the desert of Palmyra, was imported into England by Mr. Darley in 1705. About twenty years later the Godolphin Arabian² arrived on the scene, continuing to improve the English stock with infusion of North African or Libyan blood, to which the quality of the race horse is chiefly due.

Touchstone states, "The thoroughbred, as soon as he ceases to be subjected to the special régime of training reverts to the Arab type with

¹OSBORN, H. F. Points of the Skeleton of the Arab Horse. Bull. Amer. Mus. Nat. Hist., vol. xxiii, art. 13, pp. 259-263, 1907.

²Richard Berenger, however, denies that this horse was an Arab, though his view is not generally accepted. *History and Art of Horsemanship*, 1771.

such extraordinary rapidity that we cannot be blind to the fact that he descends, for at least seven parts out of eight, from the pure Arab,"¹ which we would consider of Libyan origin, and indeed many admirers of the Arab would gladly eliminate the remaining eighth of non-Arabian blood.

However the race horse of to-day is a very highly specialized animal, certainly vastly different in appearance from the Arab and yet still more widely separated from the draft-horse type.

In July, 1906, we were particularly fortunate in the gift from the late Mr. James R. Keene, of the remains of one of America's most famous race horses, together with sufficient funds for the preparation of the skeleton.

This remarkable horse, "Sysonby," was foaled February 7, 1902, at Mr. Keene's Castleton stud in Kentucky, a few months after the importation from England of his dam "Optime," his sire being the English bred "Melton." His record is one of the most brilliant in the history of American horse-racing. He won a remarkable series of victories between his first race at Brighton Beach, July 14, 1904, as a two-year-old, and his untimely death at four years (July 17, 1906).

The skeleton (Fig. 29) has been mounted to show a phase in the stride of the running horse, and is based on studies made from direct observation and instantaneous photographs. The position is that of the moment after the right fore foot has left the ground, and the right "knee" or carpus, is beginning to bend; the succeeding footfalls in order are the left hind, the right hind, the left fore and the right fore, the full length of one complete stride being about twenty-six feet.

At this instant the hind quarters are lifted perceptibly higher than the shoulders and from a rear view it will be seen that while the hind feet are thrust forward at this greater height from the ground, they are widely separated so as to avoid striking the fore legs. A moment later the shoulders will be lifted by the push of the fore feet higher than the hind quarters, then the hind feet will move toward the median line and strike the ground, and the fore feet will have moved forward out of the way of the hind.

The backbone is slightly arched to help draw together the fore and hind limbs and feet, and thus lengthen the stride and bring the back muscles into play. When viewed from above, the backbone is also observed to be curved a little to the right, owing to the forward position of the left side of the pelvis and of the left hind limb; this also lengthens and gives power to the stride as the backbone is straightened.

¹TOUCHSTONE, S. F. Race Horses and Thoroughbred Stallions.

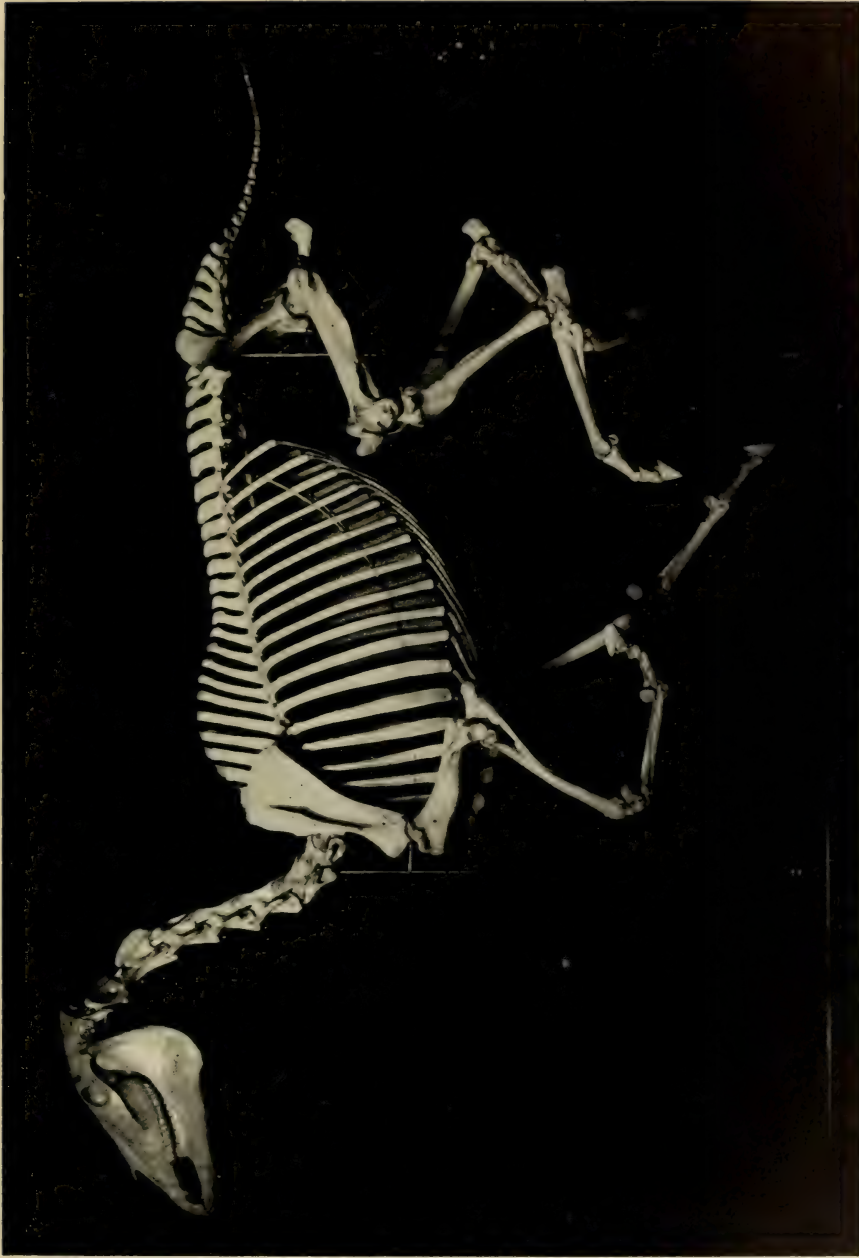


FIG. 29. THE FAMOUS AMERICAN RACE HORSE "SYSONBY." SHOWING ACTION IN THE HARD RUN

THE TEETH OF THE HORSE

[COLLECTION IN WALL CASE]

THE dental apparatus of the horse is one of the most interesting and highly specialized organs we find in nature. During the course of evolution through many ages, the teeth have gradually grown more and more complex, becoming constantly more perfectly adapted to the cropping and grinding of coarse hard grasses. They are in fact of such great size and importance that the whole skull seems constructed chiefly for their lodgment and operation, the custody of the brain, eyes and ears being, as it were, of secondary consideration; hence the skull must of necessity be very bulky, and in order that the weight may not be unnecessarily great, large air spaces (sinuses) are provided, aggregating between two and three times the amount of space occupied by the brain (specimens 51 and 5, on exhibition in wall case). Indeed the skull of the horse is a beautiful design in arches and braces, resulting in a structure of the greatest possible strength and utility with a minimum of weight and material.

The ethmoids, the bony framework of the organ of smell, are also highly developed, with a complicated system of scrolls presenting an immense amount of surface to the air that is drawn into the nostrils (specimens 5, 10 and 51).

STRUCTURE OF THE TEETH

A VERY simple form of tooth is that commonly found among the reptiles, a mere peglike structure composed of dentine with a very much harder covering of enamel on the crown, and a nerve canal in the center. We have selected three incisor teeth (Fig. 30) to show examples of different degrees of specialization. A, the tooth of a young cow, is of comparatively simple form, being somewhat flattened and having a clearly defined line or neck between the crown which is composed of dentine and completely covered with enamel and the dentine root which is without enamel. The neck, or base of the crown, as in most simple teeth, coincides with the line of the gum. In the horse the composition of the teeth is the same except that we have a third element known as cement, which begins to be deposited on the surface some time before the eruption of the young tooth, covering the enamel almost completely. In design it is more complicated. Instead of the plain upper border (Fig. 30A) there is a very deep indentation or folding in of the enamel, somewhat like the inverted finger of a glove, forming an enamel lined cup or cul-de-sac, running far down into the tooth (Figs. 30C and D), becoming more or less completely

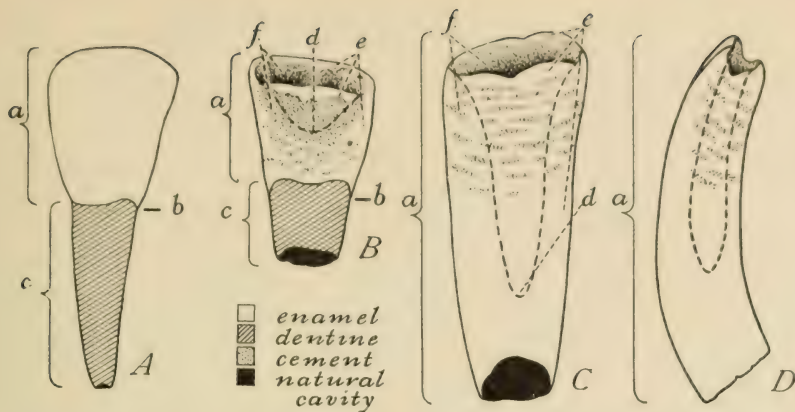


Fig. 30. Incisor teeth showing different degrees of specialization. Natural size.

- A. Permanent tooth of young cow. *a*, crown; *b*, base of crown; *c*, root
 B. Deciduous tooth of colt 4 days old. *a*, crown; *b*, base of crown; *c*, incomplete root; *d*, bottom of shallow cul-de-sac; *e*, enamel; *f*, cement deposited on enamel
 C. Permanent tooth of colt 2 years old. *a*, crown; *d*, bottom of very deep cul-de-sac; *e*, enamel; *f*, cement
 D. Side view of C. (A, B, and C, inner views)

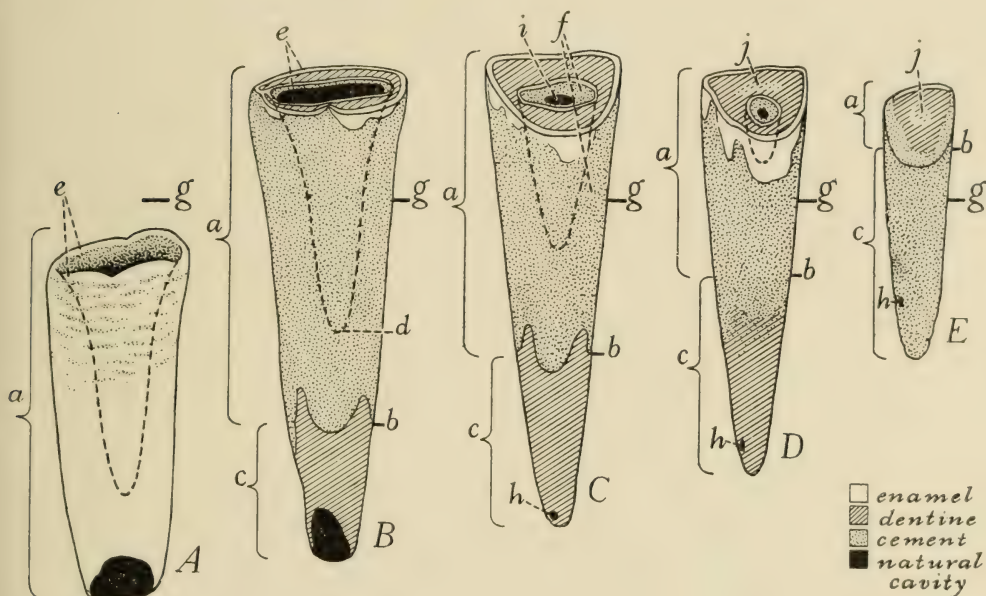


Fig. 31. Incisor teeth of the permanent set ($i.$) showing wear and movement. Inner view. Natural size

- A. Tooth of a colt 2 years old before it has erupted. *e*, folded edge of enamel, unworn
 B. Tooth of horse 4 years old. *a*, crown; *b*, base of crown; *c*, incomplected root; *d*, bottom of cul-de-sac; *e*, worn edges of enamel; *g*, gum line
 C. Tooth of horse 12 years old. *c*, root fully grown; *f*, internal and external cement; *h*, nerve foramen; *i*, natural cavity in cement
 D. Tooth of horse 17 years old. *j*, "dental star"
 E. Tooth of horse 33 years old

filled, particularly toward the bottom, with a deposit of cement. It is usually observed that highly specialized organs are more primitive in the young individual than in the adult. This is very noticeable in one specimen (Fig. 30*B*), which represents the deciduous or milk incisor of a colt about four days old. This tooth has just cut through the gum, and does not as yet show any wear from use. The enamel cup is very shallow as compared with that of the permanent tooth (*C* and *D*). It also shows a clearly defined line at the base of the crown, which when the tooth is fully grown, will coincide with the line of the gum as in the teeth of the cow and other simple teeth. The root of *B* is not as yet fully grown, but presents a large pulp cavity which will be reduced to a narrow nerve canal as the root grows longer, and tapers to a point, leaving only a very small foramen for the passage of the nerve. Figure 30*C* shows the permanent incisor of a colt two years old, which erupts and replaces its deciduous predecessor at about three and a half years. The cul-de-sac, as mentioned above, is very deep, running down almost the full length of the crown, the root not yet having begun to develop. There is already considerable cement in the cul-de-sac, and a very slight deposit beginning on the external surface about the upper end of the crown. A series of lower incisor sections and also vertical sections of incisor teeth, exhibited in the wall case, will explain the structure more clearly.

WEAR AND COMPENSATING MOVEMENT OF THE INCISORS

WHAT is frequently spoken of as "growth" in the horse's teeth is not growth, but rather movement. It is true that growth does continue in some few of the teeth until the horse is ten or twelve years old, but only in the completion and closing of the roots (see above), the crowns being all fully developed, including grinders as well as incisors, at about five and one-half years. From the time the tooth begins its service it continues to move out of the alveolar cavity, which fills with new bone, this movement counteracting the rather rapid wear of the cutting or grinding surface, so that in extreme old age some of the teeth may be worn down to the very points of the roots. One of their most remarkable specializations is the extremely long crown which instead of being entirely above the gum line, as with the more simple teeth, human for instance, extends far down into the alveolar cavity, as much as $3\frac{5}{8}$ inches in the large premolars, as a reservoir of grinding material. Figure 31 shows a series of upper incisors to explain the manner in which the tooth is worn as it proceeds from the alveolar cavity, the wearing surface altering in contour as it progresses along the crown of the tooth which constantly changes in shape toward the root.

A is the permanent tooth of a colt two years old, before it has replaced its deciduous predecessor or has received any wear, so that the external enamel is continuous with that of the cul-de-sac or internal enamel. The cement now lines the cul-de-sac and is beginning to be deposited on the external enamel. As yet the tooth has no root, but presents a wide-open pulp cavity at the base.

B is the tooth of a horse about four years old. It has recently replaced its deciduous predecessor, being in use only about six months. The folded edge of enamel is worn through, exposing the dentine beneath, and separating the enamel of the cul-de-sac from that of the exterior, with the exception of a very slight connection at the left-hand border. Internal as well as external enamel is covered with cement except on the wearing surface. The base of the crown is not clearly defined but can readily be located as it coincides with the lower border of enamel. It will be seen that this point, instead of being at the surface of the gum as in more primitive teeth, is planted about an inch and three-eighths deep, *g* indicating the gum line.

C, the tooth of a horse about twelve years old, shows a more triangular wearing surface, having been worn down a distance of perhaps three-eighths or one-half inch. The cul-de-sac is greatly reduced in surface diameter, as well as in depth. The root is fully developed and shows the nerve foramen (*h*) at the point. With the advance of age the wearing surface of the tooth, molar as well as incisor, must necessarily approach the nerve, which would subject it to exposure. This is provided for by the recession of the nerve and a new growth of dentine, reducing the nerve or pulp cavity and sometimes in extreme old age completely filling it.¹ As the tooth wears down this new dentine can be detected in the incisor by a slightly lighter shade in color, and is known among horsemen as the "dental star." It is indicated in Figure 31*D* and *E*.

In Figure 31*D*, showing the tooth of a horse about seventeen years old, the wearing surface is still more triangular. The cul-de-sac is almost worn away; the base of the crown is approaching the gum line. Not only the crown as in the younger teeth, but the root as well, is becoming thickly covered with cement, so that the base line of the crown is obliterated, but can readily be located by sectioning. On the more exposed ridges however, particularly the anterior surface, not shown in the sketch, the cement has been worn through in places by friction of the tongue and lips.

E shows the condition in extreme old age, this specimen being the tooth of a horse thirty-three years old. The cul-de-sac has long since

¹See specimen No. 132 under "Teeth sectioned to show reduction of pulp cavity" on exhibition in wall case.

disappeared and the only enamel remaining is a very narrow strip on the anterior border. The wearing surface has become elliptical, and the "dental star" has changed from a transverse line to a rounded spot. The deposit of cement has increased to almost an eighth of an inch in thickness, reinforcing the old declining root, as it were, to prolong its service to the very last.

The base of the crown has passed beyond the gum line, and at best the tooth could not last many years longer.

It is by the examination of these indications that horsemen ascertain the age, although it is impossible to judge accurately in the more advanced stages. Especial attention is given to the size and shape, presence or absence of the cul-de-sac, known among horsemen as the "mark." It should be explained however, that the lower incisors which are more easily examined in the living horse, being somewhat smaller and having a shallower cul-de-sac than the uppers just described, will acquire a certain appearance of wear at an earlier age. For instance, if *C* and *D* were lower teeth they would have a similar appearance at the ages of eight and twelve years. Considering the incisor set as a whole, it shows other marked changes with the advance of age. To render effective service the teeth must be in close contact; therefore, as each tooth is reduced in diameter it moves slightly toward the median line, reducing the total transverse measurement of the set. The meeting angle of upper and lower teeth becomes much more acute in old age. An exhibit labeled "Series of Horse Muzzles" in the wall case shows the general appearance of the incisor teeth at various ages.

The canine tooth, which is rarely found in the female except in a very abortive form, is of comparatively simple structure and has no apparent function at the present time, but may have been of service as a weapon at a very early stage of evolution. It receives almost no wear, has little or none of the compensating movement of the incisors and is, in fact, of no very great interest.

DESIGNATION OF THE TEETH

THE deciduous or milk teeth, which are shed and replaced by permanent ones, are divided into three classes: in front, the deciduous incisors, back of these, the very small deciduous canines, and still farther back, the deciduous molars.

In the permanent set the incisors and canines have replaced the deciduous ones, and the deciduous molars have been replaced by the premolars. Still back of the premolars comes a fourth class, the permanent or true molars, which have no deciduous predecessors.

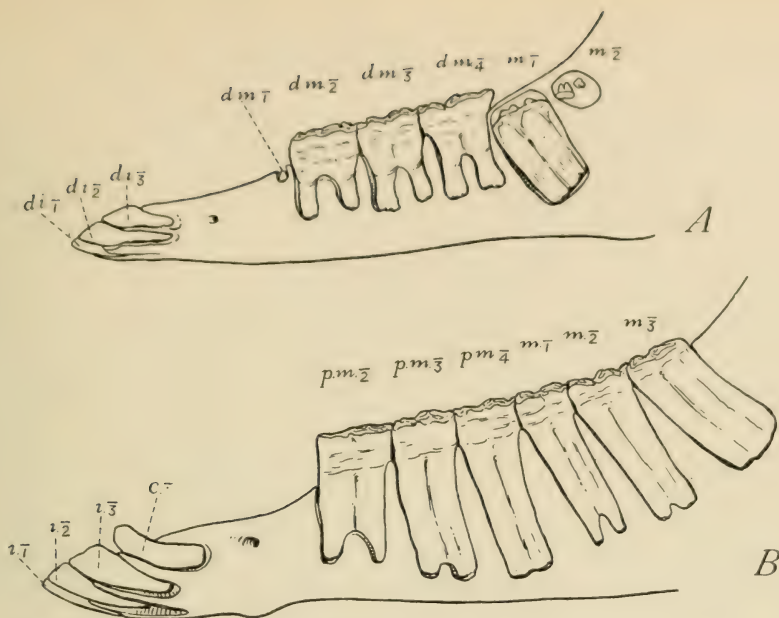


Fig. 32. Designation of teeth

- A. Lower jaw of colt 9 months and 12 days old, marked to show designation of deciduous teeth
 B. Lower jaw of horse 5 years old marked to show designation of permanent teeth

In works on comparative anatomy and zoology the teeth are expressed by initial letters and numbers in fractional form; the numerator denotes the number of upper teeth, and the denominator the number of lower teeth of each class, running back from the median line in front, and considering only one side of the skull. For instance the typical mammalian milk dentition is as follows, all being deciduous teeth: incisors three, canine one, molars four, which would be expressed $d. i. \frac{3}{3}$, $d. c. \frac{1}{1}$, $d. m. \frac{4}{4}$. The permanent dentition would be $i. \frac{3}{3}$, $c. \frac{1}{1}$, $p. m. \frac{4}{4}$, and $m. \frac{3}{3}$ —forty-four teeth in all. The human subject having only thirty-two permanent teeth, would be expressed $i. \frac{2}{2}$, $c. \frac{1}{1}$, $p. m. \frac{2}{2}$, and $m. \frac{3}{3}$.

The teeth are numbered from the median line, hence when indicating a certain tooth $i. \frac{3}{3}$ would be read, lower incisor three; $p. m. \frac{4}{4}$ upper pre-molar four; lower deciduous canine is expressed $d. c. \frac{1}{1}$. Figure 32 shows the designation of deciduous and permanent teeth. A is the lower jaw of a colt nine months and twelve days old, in which the deciduous dentition is all in use, and though the eruption of the molars has not yet begun, the development of one at least is well under way. In B, a horse about five years old, the permanent teeth are all in place. It must be borne in mind that when a subject has a reduced dentition the teeth are numbered not necessarily as they appear in the jaw, but according to what is believed to be their true relation in the typical dentition, having forty-four teeth. For instance, in the human subject where there are but two premolars

known among dentists as bicuspids, the first one in the lower jaw would be expressed *p. m.* 3. The second would be *p. m.* 4, assuming that *p. m.* 1 and *p. m.* 2 are the missing teeth. The teeth of specimens on exhibition, Nos. 10 and 36, are labeled in the manner described.

THE WOLF TOOTH OF THE HORSE

IN the horse we may say that *p. m.* 1 (Fig. 37*B*) is now in the last stage of elimination. Just in front of the upper premolars there is frequently found a very small abortive tooth commonly known as the "wolf tooth." It does also occur in the lower jaw but is very rare. It is absolutely non-functional, and is in fact detrimental, as it sometimes gives rise to more or less irritation. So that in the horse the first functional premolar is *p. m.* 2. The wolf tooth, though interesting, is rather hard to study owing to its irregularity. When speaking of the permanent teeth it is generally designated as *p. m.* 1, which would be correct if it really belonged to the permanent set; this, however, I am inclined to doubt, although it is frequently found long after the shedding period is over. Nevertheless, it seems highly probable that it is a deciduous tooth which having no successor, is not shed. In this case it would seem that the permanent tooth had been eliminated earlier in the course of evolution than the deciduous one. But until we have more conclusive evidence on this point probably it will be as well to include the wolf tooth among the teeth with which we find it. In figure 32*A* there is shown the unusual occurrence of the wolf tooth in the lower jaw. In looking over the fossil ancestors it seems this tooth began to show signs of elimination in the late Oligocene Period, which is estimated to be about two million years ago. At this rate we may reasonably hope for some few social reforms before the horse is entirely rid of this rather undesirable appendix.

PREMOLARS AND MOLARS OF THE HORSE

WHEN we compare the molar tooth with its most intricate structure, with the incisor, the latter seems perfect simplicity. Without here discussing the evolutionary history of the tooth, it is extremely interesting to consider these special adaptations, which are merely gradual modifications of a simple form brought about without any radical or sudden changes, but slowly developed in an orderly and shall we say, orthodox manner.

The molar of the horse as we find it to-day is a wonderful structure, presenting on its grinding surface a most complicated system of sharp

enamel edges almost as hard as glass, supported on one side by dentine and on the other by cement. These materials being somewhat softer than enamel, wear down slightly in advance, leaving the enamel edges sufficiently exposed to give a perfect self-sharpening, grinding surface, but at the same time not projecting so far beyond the general plane as to be in danger of chipping off.

When we compare such a tooth as this with a perfectly simple one, composed of dentine and having a short, either cone-shaped or flattened crown, covered merely with a smooth shell of enamel without cement, it is difficult at first sight to see any relation or similarity between them, or to realize that the highly specialized organ is simply a development of the primitive one. But let us by way of illustration imagine for a moment a tooth with a crown in form somewhat like a pillar or post, composed of dentine with two deep depressions in the top, the dentine being completely covered with enamel, and a thick deposit of cement on the surface of the enamel.

When the cement and enamel are worn through on the grinding surface we would have the exposed edge of an enamel cylinder filled with dentine, reënforced with cement on the outer surface, and two enamel rings, or rather pockets with the edges exposed, imbedded in the dentine. These pockets or depressions would be lined on their inner surfaces, or completely filled, as the case might be, with a deposit of cement. This would be a construction similar to that we have already seen in the incisor, except that we have two instead of the single cul-de-sac. Now let us imagine the enamel walls of these culs-de-sac, and also the enamel cylinder, deeply crenated or folded and doubled, in some places the latter coming almost in contact with the former, thus increasing greatly the exposed enamel edges, and we will have the design of the grinding surface of an upper deciduous molar after it is somewhat worn (Fig. 33A). And here it must be borne in

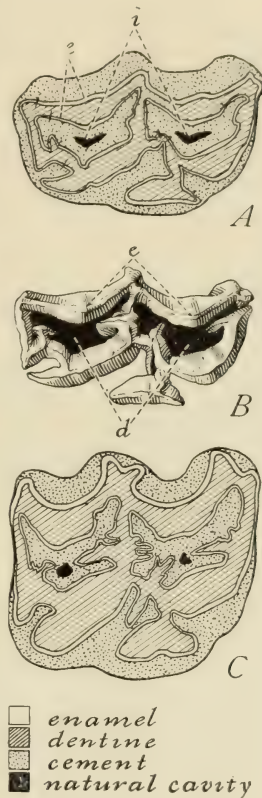
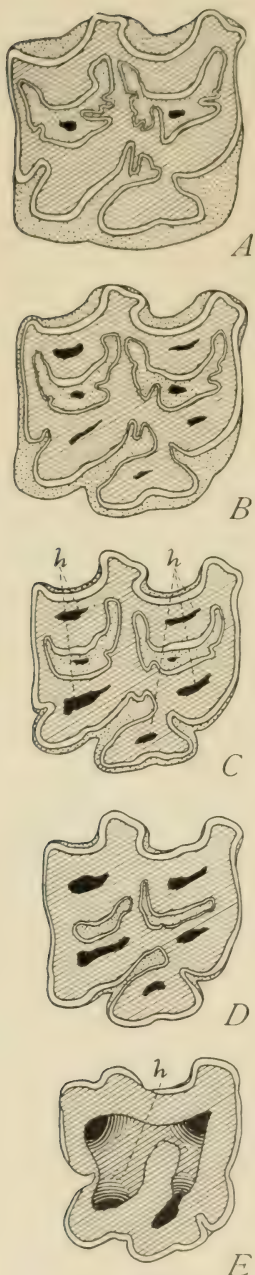


Fig. 33. Wearing surface of upper grinding teeth. Natural size

- A. Worn surface of deciduous molar (*d. m.* 4) of colt about 6 months old. *e*, exposed enamel edges; *i*, natural cavity in cement.
 B. Unworn surface of deciduous molar (*d. m.* 4) of colt about 3 months before birth, showing only enamel. *d*, cul-de-sac to be filled later with cement; *e*, apex of folded edge of enamel.
 C. Premolar (*p. m.* 2) of horse 8 or 9 years old



- enamel
 ▨ dentine
 ▩ cement
 ■ natural cavity

mind that the horse's teeth are not fully functional until the folded edges of enamel on the grinding surface are worn through to the dentine.

Figure 33B shows the deciduous upper molar (*d. m.*⁴) of a colt about three months before birth. The enamel of the culs-de-sac is continuous with that of the exterior, the folded edges on the grinding surface being unworn. It is as yet entirely without cement so that we have an unobstructed view of the enamel. When the colt is six months old, however, the culs-de-sac will be practically filled with cement and also the deep folds of the exterior (Fig. 33A), the deposit of cement beginning about a month before birth.

We have seen that the permanent incisors are much more highly specialized than are the deciduous ones (Page 48). This is quite as noticeable in the grinding teeth. Observe the wonderful development of enamel edges in figure 33C. This is a premolar of a horse eight or nine years old. A careful measurement of the exposed enamel in this tooth reveals the interesting fact that if these edges were straightened out in a continuous line, it would be fourteen inches in length. In a tooth of this size on the simple "cylinder" plan, it is obvious we would have only about four inches of enamel, hence we can willingly concede nature's wisdom in this comparatively "modern improvement."

This enamel pattern however, presents a more simple aspect as the tooth wears down toward the base of the crown, so that in old age when the grinding surface is near the root, there is less enamel, and the self-sharpening surface is much less perfect. The antero-

Fig. 34. Upper grinder (*p. m.*⁴) of horse 10 or 11 years old cut in 5 sections; showing pattern of enamel at various ages

C, h. Branches of the pulp cavity
 E, h. Pulp cavity

posterior diameter of the crown is also reduced toward its base.

Figure 34 shows an upper right grinder (*p. m.*⁴) of a horse ten or eleven years old. The tooth is cut in five sections, and reveals on each cut surface, the pattern of enamel which will be presented on the naturally worn grinding surface at various ages.

Section *A* is a diagram of the natural grinding surface as it appeared in life, and shows a very complicated pattern of enamel, and large culs-de-sac almost completely filled with cement.

Section *C* which is cut one and one-fourth inches farther along the crown, shows great simplification of enamel pattern, and the culs-de-sac are much smaller. The five branches of the pulp cavity (*h*) are open, but would have been filled with new dentine before the natural grinding surface reached this point which takes place when the horse is approximately twenty-five years old.

Section *E*. The lower border of enamel which marks the base of the crown where this section is cut, is somewhat irregular, so that the enamel line is incomplete. This explains the three spaces which can be

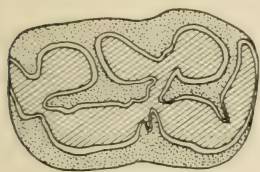


Fig. 35. Lower premolar (*p. m.*₃) of horse 8 or 9 years old

seen in the external enamel. The culs-de-sac are entirely eliminated and the enamel edges are reduced to a minimum. The antero-posterior diameter is also greatly reduced. The branches of the pulp cavity are united at this point (*h*), where the roots begin to diverge. This tooth, *p. m.*⁴, being the youngest tooth in the grinding set, would not be worn down to the base of the crown until the horse reached thirty-five or more years, an age very rarely

attained. Sections of grinding teeth on exhibition, particularly specimen No. 95, will be of interest as illustrating structure and wear.

The lower molars in their construction are quite similar to the uppers, one of the most striking differences being the absence of the culs-de-sac. Much the same result is acquired however, by the very deep folding in of the external enamel, which at various points almost meets toward the center (Fig. 35). The lower molars are also narrower in their transverse measurement.

There are several points which sometimes lead to a little confusion in observing the grinding surface of the molars. For example, at the bottom of the deeper concave surfaces of dentine between the enamel lines, there is a dark brown mark which is sometimes mistaken for a fourth material, but is merely a coloration of the dentine.

In the upper molars we generally find two small cavities (Fig. 33*A* and *C*), one in each cul-de-sac, which sometimes gives rise to question-

ings, and indeed there have been swindlers masquerading as veterinary dentists, who would gladly "fill" your horse's teeth for a reasonable consideration. These cavities however are perfectly normal, and we have precisely the condition here as in the incisors except that in the molar the cement is very much thicker, and the presence or absence of the cavity depends simply upon the thickness of the cement.

It will be seen that where the tooth comes in close contact with its next neighbor, the cement is missing, and indeed, sometimes the continuous line of external enamel is broken (Fig. 35). This is due to a slight wear on the side of the tooth. There is a strong tendency to crowd toward each other, thus preventing the forcing of food material between them. The slight vibration when in use, of each tooth in its alveolar socket, affords sufficient wear to keep them perfectly fitted together, and also explains the apparent break in the external enamel wall, which we frequently see. This crowding together, as well as many other features, can best be observed from the side view. On exhibition are a number of skulls having the bone cut away in order to expose to view the full length of the tooth.

The three posterior teeth or molars, incline very considerably to the front, while the other three, the premolars, lean slightly toward them (Fig. 37), so that when pressure is applied on their grinding surfaces they are forced together like stones in the arch of a building. And as the teeth wear down to a point of smaller diameter, the last molar in extreme old age assumes an almost horizontal position (Fig. 37C).

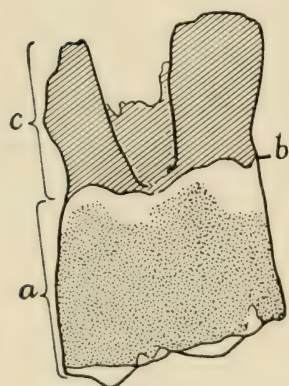


Fig. 36. Deciduous molar (*d. m.* ³) of colt 11 months old. Natural size. *a*, crown; *b*, base of crown; *c*, root

¹See page 15.

The grinders from a lateral view present a most formidable looking dental battery. It gives some idea of their development when we find that a full set of premolars and molars, taken from a fair-sized horse of four or five years, will weigh about four pounds, the premolars being a little larger than the molars, a fact which is quite unusual, as in the great majority of mammals the premolars are very much inferior in size and development, as was also the case in the ancestral horse.¹

We see from the lateral view as well as from the grinding surface, the more highly specialized characters of the permanent tooth. Compare the very long crowns of figure 37A with the deciduous molar (Fig.

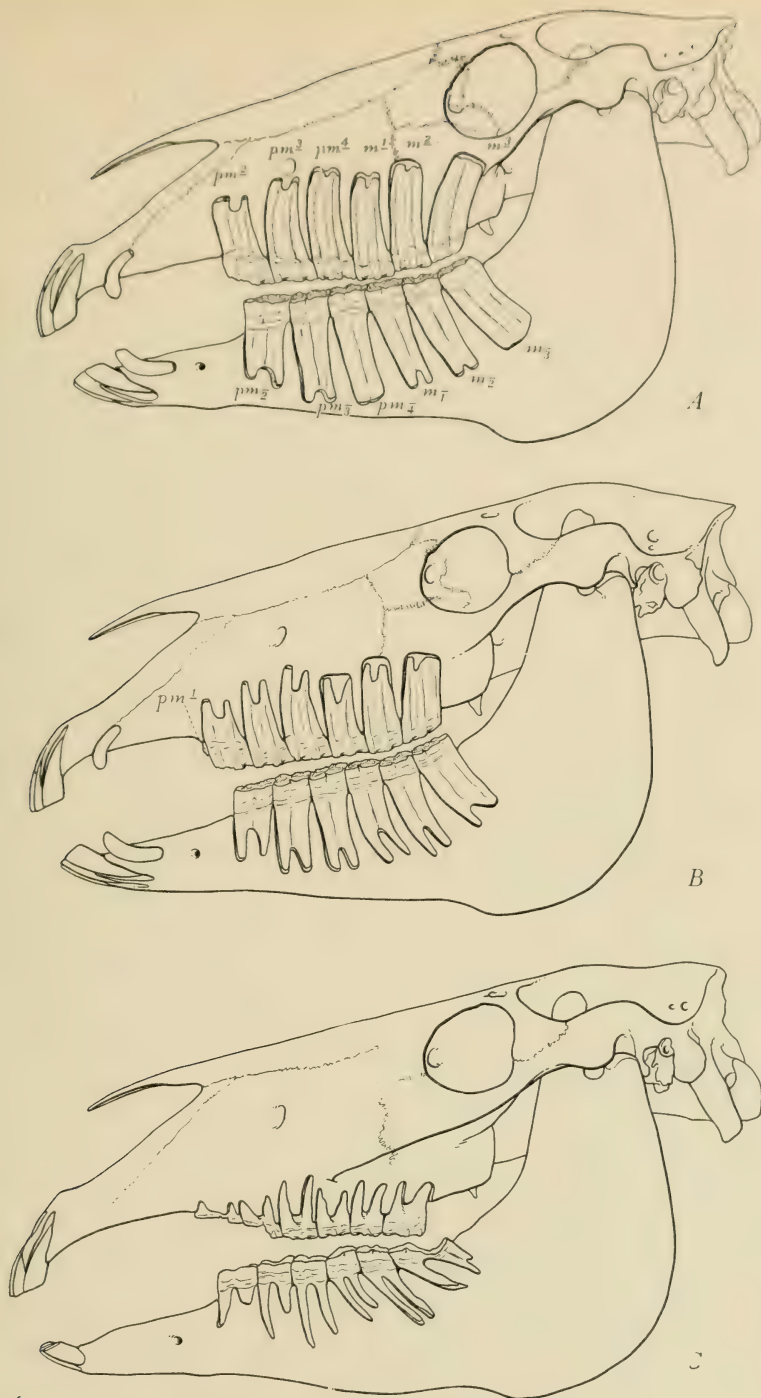


Fig. 37. Dental battery of adult horse

- A. Skull 5 years old. Permanent teeth all in use
 B. Skull 8 years old. Crowns reduced in length by wear and roots grown longer. Vestigial *p. m. 1* present in this individual
 C. Skull 39 years old. Crowns almost worn away. Lower molars incline forward. (The canines are absent in the female)

36), with its short crown, clearly defined base line and flaring roots.

Wear and movement of premolars and molars can be studied very readily from the skulls on exhibition, three of which are shown in figure 37.

For the present we will consider only the lower teeth, which will apply in a general way to the upper as well. The growth of the tooth begins at the grinding surface, inside the alveolar cavity, and proceeds toward the root, the tooth constantly moving upward, erupting and beginning to wear off before even the crown is complete.

Figure 37A shows the skull of a horse about five years old. The deciduous set has been shed and the permanent teeth are all in use, though the wolf tooth (*p. m.* $\frac{1}{1}$) is not present in this specimen.

The crown of *p. m.* $\frac{4}{4}$, the last tooth in the grinding set to reach the wearing line, is now fully grown, having already lost about half an inch from wear. It now measures three and a half inches, making a total length of four inches to be slowly moved upward and worn away. The roots are just beginning to develop at the base of the crown. The next tooth back of this, *m.* $\frac{1}{1}$, is the first permanent tooth to appear, hence the oldest one in the mouth. The crown is worn down much shorter than that of *p. m.* $\frac{4}{4}$, and the roots are quite evident, though still incomplete.

In figure 37B, showing a specimen about eight years old, the crowns have all been perceptibly reduced by wear, and the roots are all more or less developed, those of *m.* $\frac{1}{1}$ being almost completely grown.

The oldest skull¹ in our exhibit is a specimen from a horse thirty-nine years old, figure 37C. The crowns are almost entirely worn away. Some of the roots are very much elongated, while others are thickened by an extreme reënforcement of cement. The molars are very much inclined forward, particularly *m.* $\frac{3}{3}$, which is so worn as to almost separate the two roots. In the upper set, *p. m.* $\frac{2}{2}$ is represented only by irregularly shaped lumps of cement which surround the last fragments of roots, prolonging to the utmost their very much impaired service.²

ERUPTION OF THE TEETH OF THE HORSE

THE calcification of all the deciduous teeth and also *m.* $\frac{1}{1}$ begins before birth. When the colt is born, *d. i.* $\frac{1}{1}$ and *d. m.* $\frac{2}{2}$ and $\frac{3}{3}$ are very near the surface of the gum, and generally erupt within two or three days; *d. m.* $\frac{4}{4}$ is apt to follow during the first month; *d. i.* $\frac{3}{3}$, the last deciduous tooth to erupt, makes its appearance as late as the eighth or tenth month. The three deciduous molars seem very large for

¹Since writing, a skull 42½ years old has been obtained, Specimen No. 138, on exhibition.

²Specimen No. 132 in wall case shows interesting examples of reënforcement by cement in extreme old age.

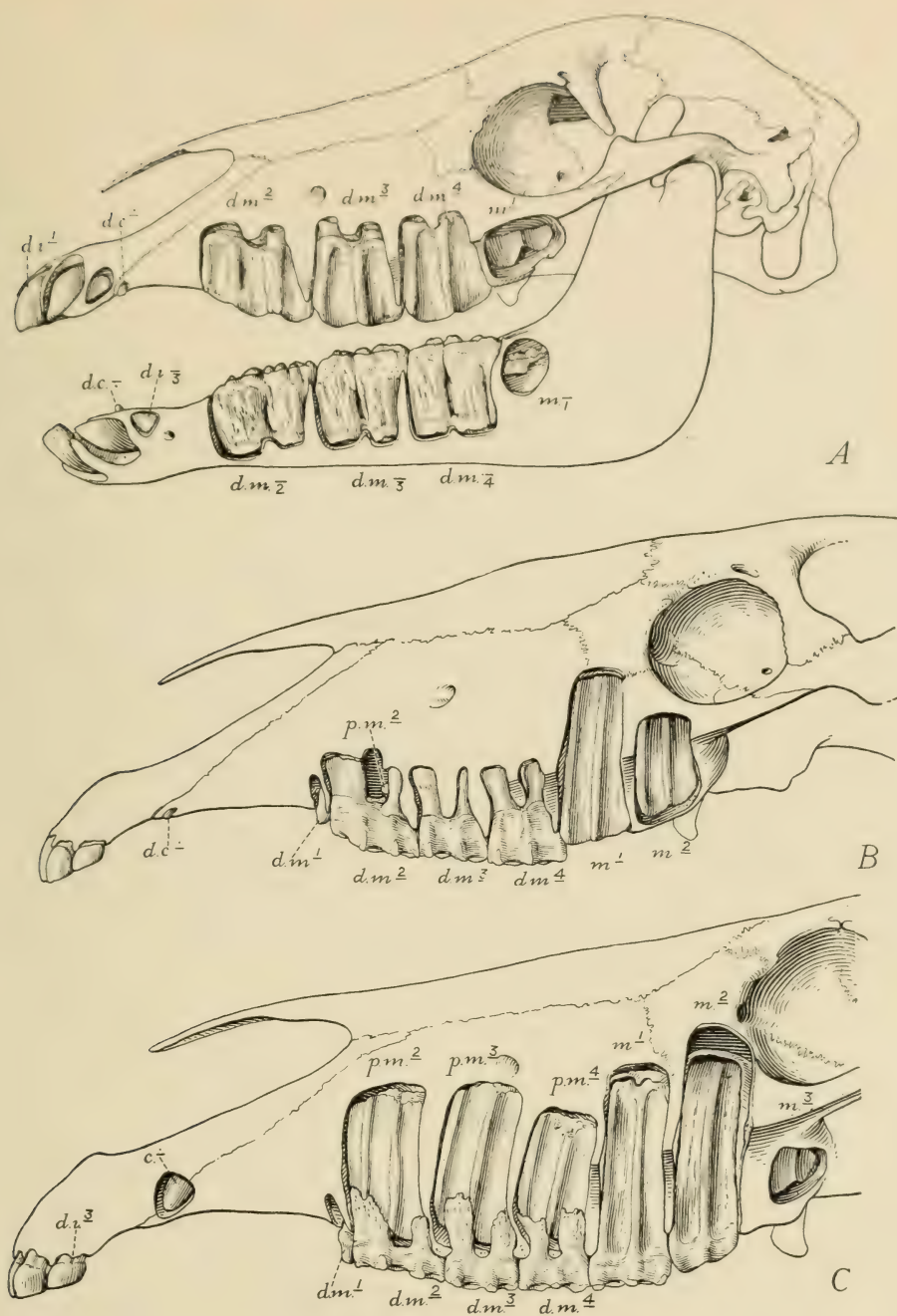


Fig. 38. Dentition of the colt

- A. Colt 2 days old showing deciduous teeth and beginning of $m.^1_1$
- B. Eleven months old. Deciduous teeth somewhat worn and permanent set developing
- C. Two years old. Deciduous teeth very much worn and permanent set partly in use

the size of the young skull, their antero-posterior measurement being a little greater than that of their successors, the premolars, and occupy the entire space in the skull which will finally accommodate the whole grinding set, so that $m. ^1$ is crowded far back, beginning its development in the alveolar cavity directly below the eye socket, as shown in figure 38A, a colt two days old. This discrepancy, however, is nicely adjusted. As fast as the increasing size of the skull will permit, the teeth are crowded forward with a horizontal movement, making room at the back for the development of the molars, each one resigning its birth-place below the eye, and moving forward to make room for the next one to fall in line, the operation being about the same in the lower set as in the upper teeth.

The incisors also encroach upon the region of the very small $d. c. \div$ particularly $d. i. \overline{3}$, which begins its development well back of the $d. c. -$ (Fig. 38A). As the jaw grows, $d. i. \overline{3}$ passes forward and assumes its final position in front of the $d. c. \overline{4}$.

At eleven months (Fig. 38B) the deciduous teeth are all in use and most of them considerably worn. $m. ^1$, which is due to erupt within about a month, has increased wonderfully in length and has moved forward, giving up the place under the eye to $m. ^2$, which has already attained considerable size, and has advanced somewhat in its forward movement. Between the roots of $d. m. ^2$, which are flattened and widely spread apart, thus making room for the new tooth, the calcification of $p. m. ^2$ is just beginning. $i. \frac{1}{1}$ is developing, and can be seen in specimen No. 38¹ far back in the alveolar cavity under the root of $d. i. \frac{1}{1}$, but is not visible in the figure.

In figure 38C, a colt of two years, calcification has begun in all the permanent teeth except $i. \frac{3}{3}$. The crowns of the deciduous molars are nearly worn away, while the roots are being absorbed by the growth of the premolars which have now attained a considerable size. $m. ^1$, the first permanent tooth to erupt, has been in wearing about a year and is just beginning to develop roots. $m. ^2$ has cut through the gum and is very slightly worn. The alveolar cavity below the eye, is now lodging its last young tenant, $m. \frac{3}{3}$, which by the time it is full grown will have moved nearly two inches anterior to its present position.

SHEDDING THE TEETH

BEFORE the deciduous molars are shed the crowns are almost entirely worn away on the one side, while the roots are absorbed by the new teeth on the other, so that there is only a small fragment of tooth really lost. The time of shedding may vary a number of months: At three years approximately, $d. m. \frac{2}{2}$ and $\frac{3}{3}$ are shed, exposing the grind-

¹On exhibition in wall case.

ing surface of *p. m.* $\frac{2}{2}$ and $\frac{3}{3}$. *m.* $\frac{1}{1}$ and $\frac{2}{2}$ are in use and somewhat worn. At about three and one-half years *d. i.* $\frac{1}{1}$ will be shed. At four the shedding of *d. m.* $\frac{1}{1}$ follows very closely after, or sometimes during the eruption of *m.* $\frac{3}{3}$. A little later *d. i.* $\frac{2}{2}$ is shed. At about five or a little before, the canines will erupt and *d. i.* $\frac{3}{3}$ are shed, and the permanent dentition is all in use. There are a number of specimens on exhibition in the wall case, not figured in this description, which it would be well to consult in connection with the shedding of teeth.

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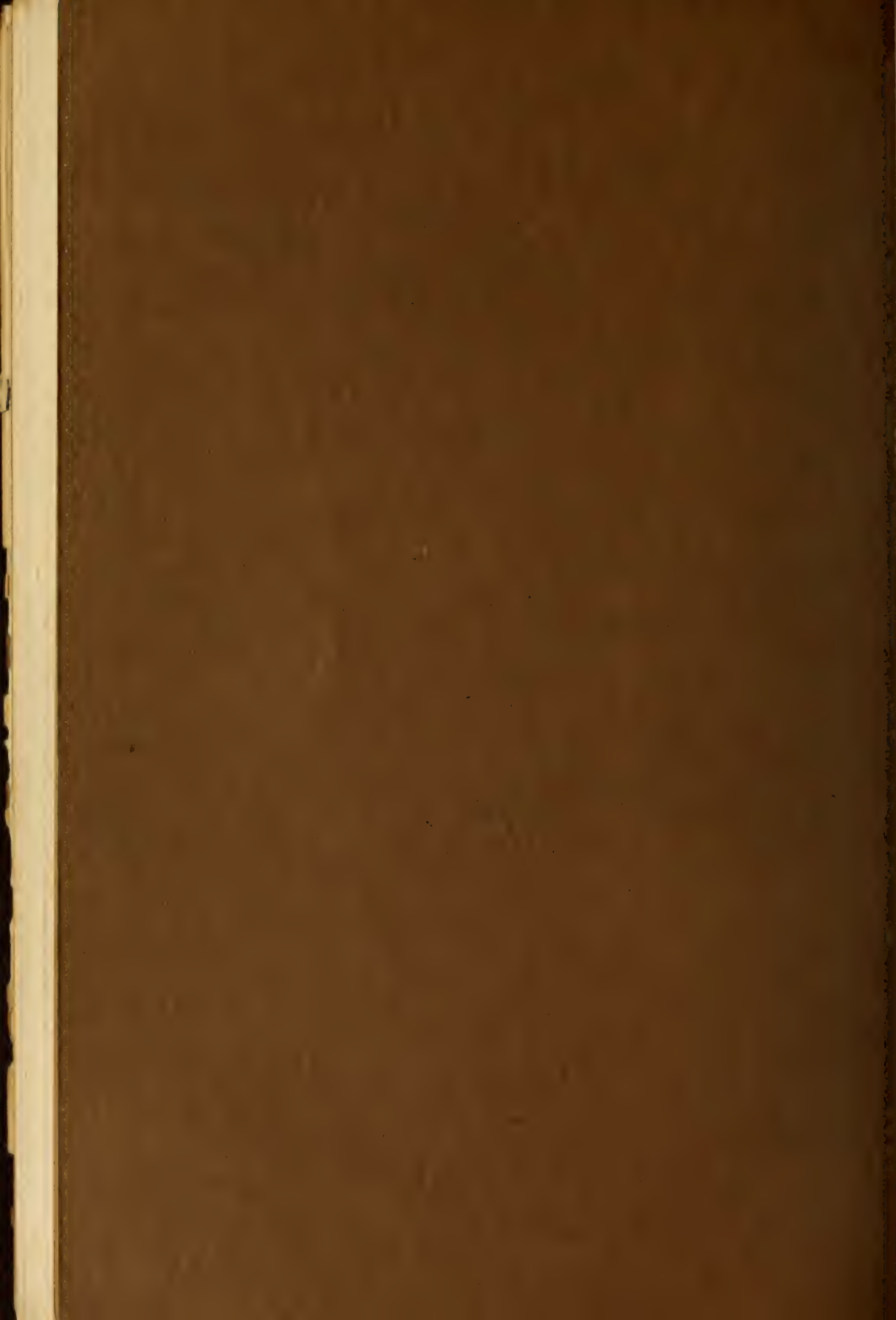
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THE AMERICAN MUSEUM OF NATURAL HISTORY was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people, and it is in cordial coöperation with all similar institutions throughout the world. The Museum authorities are dependent upon private subscriptions and the dues from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

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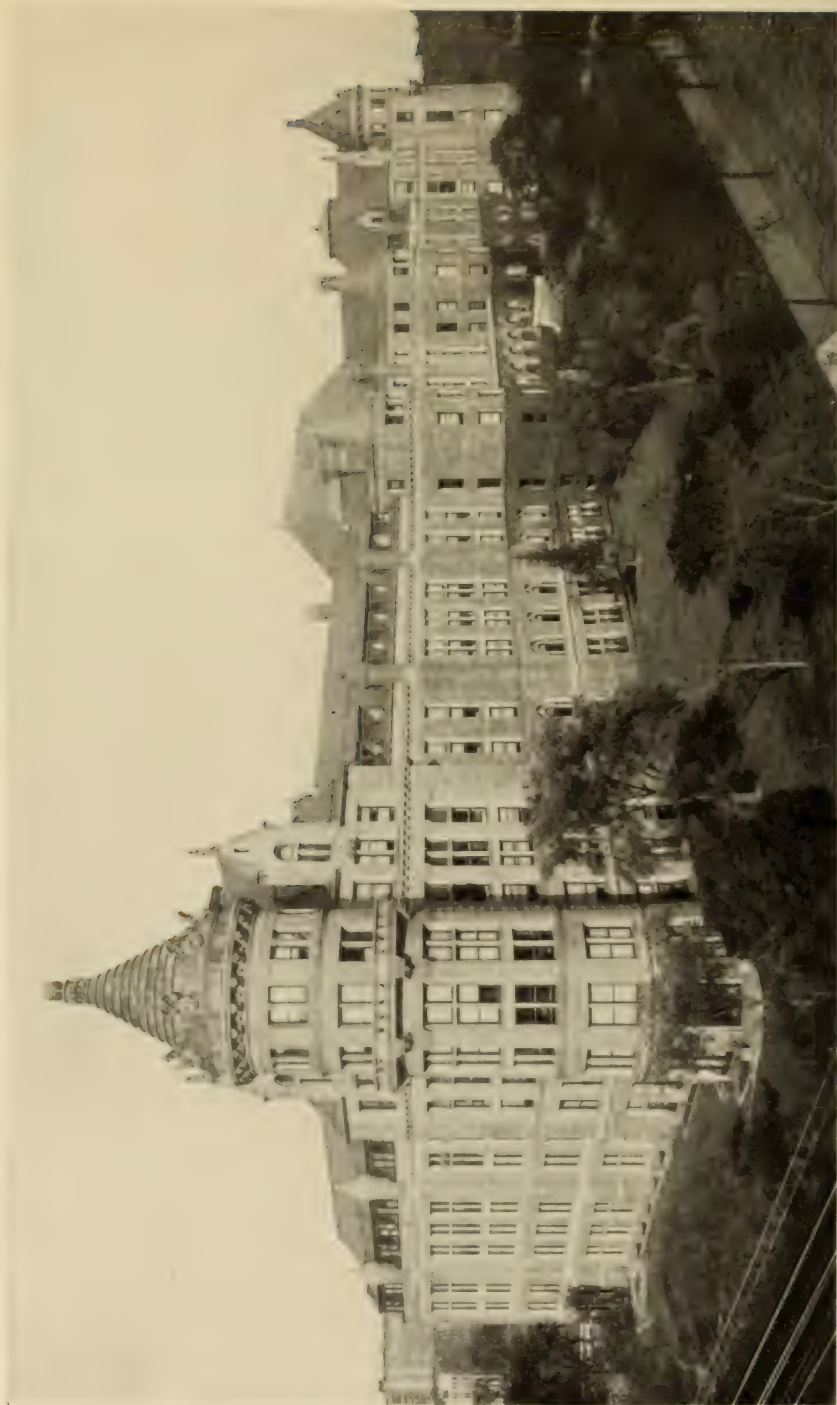
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THE AMERICAN MUSEUM OF NATURAL HISTORY OF WHICH THE CORNER STONE WAS LAID IN 1874 BY PRESIDENT U. S. GRANT

This is the Southern Façade which measures 710 feet from tower to tower. Eastern, western and northern façades comparable with this in length are designed for the completed structure, which will be larger than any building in the world to-day even the Imperial of Spain or the National Capitol at Washington.

GENERAL GUIDE
TO THE
EXHIBITION HALLS
OF THE
AMERICAN MUSEUM
OF NATURAL HISTORY

BY
FREDERICK A. LUCAS, Director
Assisted by Members of the Museum Staff



GUIDE LEAFLET SERIES No. 37

MARY CYNTHIA DICKERSON, Editor

New York. Published by the Museum. July, 1913

The first General Guide to the Collections, comprising 54 pages and 16 illustrations, was issued in January, 1904.

The second General Guide, of 96 pages and 54 illustrations, was published in November, 1911.

The present editions consist of 116 pages and 63 illustrations.

A complete list of the popular publications of the Museum will be found at the end, beginning on page 115.

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The halls are named according to the position they will have in the completed Museum building which will consist of four long façades facing east, west, north and south respectively, each connected with the center of the quadrangle formed, by a wing extending between open courts. Thus the hall at the eastern end of the south façade (the only façade completed) becomes the "southeast pavilion."

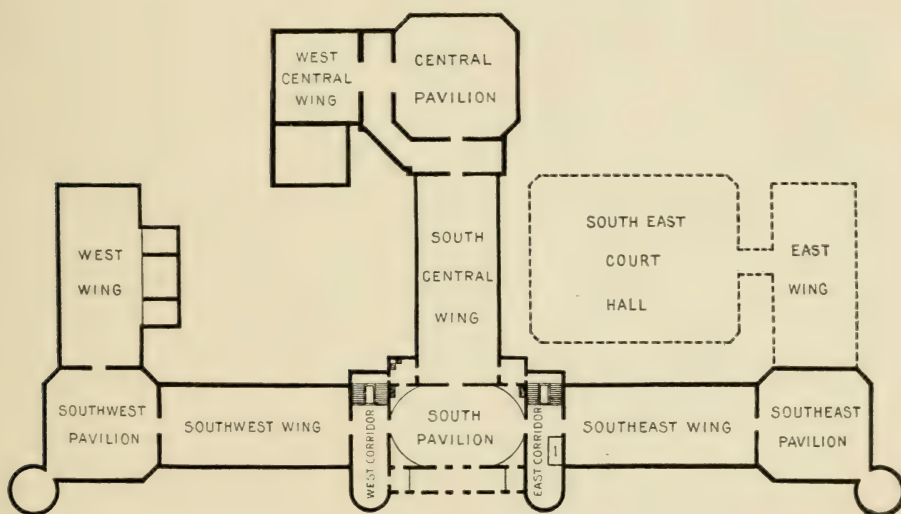
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Prefatory Note

It is the purpose of this GUIDE to call attention to the more important exhibits that the visitor will see as he passes through the halls. More detailed information regarding the specimens may be obtained from the labels or from the *Guide Leaflets*.

It is frequently necessary to rearrange the exhibits in order to provide space for new material or to put into effect advanced ideas regarding methods of exhibition, and as these changes are taking place all the time, it unavoidably happens that now and then discrepancies will be found between the actual arrangement of the exhibits and that noted in the GUIDE. Dr. Goode has said that a finished museum is a dead museum, and it is hoped that the visitor will look upon these necessary changes as indications of life and progress.



The halls are named according to the position they will have in the completed Museum building, which will consist of four long façades, facing east, west north and south respectively, each connected with the center of the quadrangle formed, by a wing extending between open courts. Thus the hall at the eastern end of the south façade (the only façade completed) becomes the "southeast pavilion."

GENERAL GUIDE TO THE MUSEUM

INTRODUCTION

The History and Work of the Museum

THE American Museum of Natural History was founded and incorporated in 1869 for the purpose of establishing a Museum and Library of Natural History; of encouraging and developing the study of Natural Science; of advancing the general knowledge of kindred subjects and to that end, of furnishing popular instruction.

History

For eight years its temporary home was in the Arsenal in Central Park. The corner stone of the present building in Manhattan Square was laid in 1874 by President U.S. Grant, and in 1877 the first section (South Central Pavilion) was completed.

Location

The Museum is located at 77th Street and Central Park West, and can be reached by the 8th or 9th Avenue surface cars, the 6th or 9th Avenue elevated to 81st Street station, or by the subway to 72nd or 79th Street station. The Museum is

Hours of Admission

open free every day in the year; on week days from 9 A.M. to 5 P.M., on Sundays from 1 to 5 P.M.

The Museum building is one of the largest municipal structures in the City, and has cost approximately \$5,000,000. The South Façade is 710 feet in length; the total area of the floor space is 470,789 square feet, or about 10 acres, of which 271,886 square feet are open to the public. The building when completed is designed to occupy all of Manhattan Square.

The building is erected and largely maintained by the City, through the Department of Parks. Building funds are provided for by issues of Corporate Stock, which have been made at intervals since 1871. The annual appropriation, known as the Maintenance Fund, is devoted to the heating, lighting, repair and supervision of the building and care of the collections.

Administration and Support

The Museum is under the control of a self-perpetuating Board of Trustees, which has the entire direction of all its activities as well as the guardianship of all the collections and exhibits. The Trustees give their services without remuneration.

The funds which enable the Trustees to purchase specimens, to carry on explorations and various forms of scientific work, to prepare and publish scientific papers and to enlarge the library are raised by contributions from the Trustees and other friends. These contributions come from three sources—namely, (1) the Endowment Fund, (2) Membership Fund, (3) voluntary subscriptions.

There are at present about 3,500 Members. Annual Members contribute \$10 a year for the support of the Museum; Life Members make a single contribution of \$100. Membership fees are of great service in promoting the growth of the institution.

In the last edition of the Century Dictionary a museum is defined as:

Definition of a Museum "A collection of natural objects, or of those made or used by man, placed where they may be seen, preserved and studied. Neither the objects themselves, nor the place where they are shown constitutes a museum; this results from the combination of objects, place and purpose, display being an essential feature. The objects, or specimens, may be shown for general purposes only, or for the illustration of some subject or idea, the tendency of modern museums, being by the display of objects and the manner in which they are arranged and labeled to illustrate some fact in nature or in the history of mankind."

And E. Ray Lankester has very clearly stated that:

Purposes of Museums "The purposes of a great national museum of natural history are (1) To procure by its own explorers or by the voluntary assistance of independent naturalists the actual specimens upon which accurate knowledge of the animals, plants, and minerals of the earth's surface, and more especially of the national territory, is based; to preserve and arrange these collections for study by all expert naturalists, and to facilitate, directly or indirectly, the publication (in the form of catalogues or monographs) of the knowledge so obtained—with a view to its utilization, not only in the progress of science, but in the service of the State. (2) To exhibit in the best possible way for the edification of the public, at whose charges these collections are made and maintained, such specimens as are fitted for exposure in public galleries, with a view to the intelligent and willing participation of the people in the maintenance of the Museum."

How These Purposes Are Carried Out The Museum not only maintains exhibits "for the edification of the public," but supplements the educational work performed by these and their accompanying labels, by lectures and publications of a popular nature. A course of evening lectures is given every Spring and Fall for the Members, to which admission is to be had by ticket; another series of lectures, free to the public, is given in conjunction with the Board of Education on Tuesday and Saturday evenings. Still another series, under the direction of the Museum's, Department of Public Education, is given for the children in the Public Schools, and there are special lectures for the blind provided for by the Thorne Memorial Fund. The educational work of the Museum is carried still farther by means of its circulating collections for illus-

trating nature study which are sent free to the schools of Greater New York. The extent to which these collections are used is shown by the following statistics for the last five years:

	1908	1909	1910	1911	1912
Number of Collections in use..	484	435	390	512	537
Number of Schools of Greater New York Supplied.....	383	419	334	486	491
Number of Pupils studying the Collections.....	575,801	922,512	839,089	1,253,435	1,275,890

The scientific side of the work of the Museum is based upon its explorations and study collections.

The Study Collections, as the name implies, are not only for the benefit of students but preserve a record of our vanishing animal life and of the life and customs of our own and other primitive peoples.

In the case of Natural History the vast majority of the specimens are in the study series, not only because they would ultimately be ruined by exposure to light but because the display of all material would only confuse the visitor. Moreover, no museum has room to show everything, and a careful selection is made of objects of the greatest educational value and these are so displayed as to enhance their interest and attractiveness.

The Study collections are, briefly, as follows;

Anthropology.—ETHNOLOGY.—On the attic floor of the west wing and the northwest pavilion there are thirty-three fire-proof store rooms containing the ethnological study collections of more than 100,000 catalogue numbers, comprising extensive series for the Philippine Islands, Siberia, China, South Sea Islands, Africa, South Africa and the various culture areas in North America.

Archæology.—In archæology there is a large type series of stone objects from the various States of the Union. Full collections from excavated sites in British Columbia, Washington State, New York State, Kentucky, Arizona and New Mexico are here, together with a special series from the Trenton Valley. There is much material from Mexico, Peru and Bolivia.

The human skeleton material is chiefly from western States and South America. About two thousand crania have been classified and made available for study.



CHILDREN STUDYING MOOSE GROUP

Geology and Invertebrate Palæontology.—The study collections comprise, among other things, the Hitchcock series of rocks illustrating thirteen geological sections across the States of Vermont and New Hampshire; a complete set of duplicate specimens from the United States geological survey of the Fortieth Parallel; a series illustrating the early geological survey of Pennsylvania; a complete typical series of rocks and microscopic thin sections illustrating Rosenbusch's manual of petrography; large series of American rocks; a complete series typifying the rocks encountered in driving the Simplon tunnel, Switzerland; many ores and economic specimens.

Invertebrate Palæontology.—Great numbers of fossil invertebrates, too numerous and varied to particularize, but representing many of the important groups.

Ichthyology and Herpetology.—**ICHTHYOLOGY**.—The collection of fishes comprises about 7,000 catalogued specimens, preserved in alcohol and kept in tanks and jars.

The fossil fish collection is one of the largest, if not the largest, in America, comprising about 10,000 catalogued specimens; it includes the Newberry, the Cope and several smaller collections.

HERPETOLOGY.—The collection of frogs, salamanders and reptiles numbers 9,000 specimens.

Invertebrate Zoölogy.—**GENERAL INVERTEBRATES**.—About 60,000 specimens of protozoans, sponges, polyps, starfishes, sea-urchins, worms, crustaceans, spiders, myriapods and chordates.

INSECTS.—(a) Local collection comprising insects known within fifty miles of New York City. (b) General collection including more than 500,000 specimens, among them the types of many species.

SHELLS.—The chief Molluscan collections of the Museum, exclusive of fossils. About 15,000 species are represented, comprised for the most part of the Jay and Haines collections.

Mammalogy and Ornithology.—**MAMMALOLOGY**.—The study collection of mammals contains about 25,000 skins, skulls and skeletons. It is especially rich in South American forms. Mexico and the Arctic are well represented; from the latter region there is a large and unique series of the beautiful white Peary's caribou and of the Greenland muskox, comprising about 150 specimens. The collection of whales is likewise noteworthy.

Ornithology.—The study collection of birds consists of approximately 90,000 unmounted skins, about nine-tenths of which are from the Western Hemisphere, and several thousand nests and eggs. South America is chiefly represented by a large collection from Matto Grosso, Brazil, and extensive collections from Colombia; also smaller series from Ecuador, Peru, Venezuela and Trinidad.

From North America, there are important collections from Mexico, Nicaragua, California, Texas, Arizona and the Middle Atlantic States—the Rocky Mountain region being most poorly represented. Of special collections, the George N. Lawrence and Maximilian collections are of special importance from the hundreds of type specimens which they contain.

Mineralogy.—Most of the mineral specimens are on exhibition, but the overflow from the public cases forms a study series of no mean proportion.

Public Health.—Living bacteria are maintained and distributed free to recognized laboratories.

Vertebrate Palæontology.—The study collections comprise about 15,000 catalogued specimens of fossil mammals, 6,000 fossil reptiles and amphibians and a few hundred fossil birds. Most of these are from the western United States. The collections of fossil horses, Eocene mammals and Cretaceous dinosaurs are unrivaled. The fossil rhinoceroses, camels, oreodonts, carnivora, Fayûm, Pampean and Patagonian mammals, Jurassic dinosaurs, Permian reptiles, turtles, etc., are likewise of the first rank. They include more than nine hundred type specimens of fossil mammals and several hundred type specimens of fossil reptiles and amphibians.

The Museum Library, located on the fifth floor, contains about 70,000 volumes on various branches of natural history (save botany), anthropology and travel. It is particularly strong in vertebrate palæontology and scientific periodicals. Like other museum libraries, it is of necessity a reference library, but, except on Sundays and holidays, may be freely used by the public during the hours when the Museum is open.

The publications of the Museum, aside from the *Annual Report*, fall naturally into two groups: scientific and popular. The former, comprising the *Memoirs*, *Anthropological Papers* and *Bulletin*, contain information gathered by the various expeditions, or derived from the study of material collected; they are from the nature of their subjects mainly of a technical character. The *Memoirs* consist of the larger, more important papers, or those that call for unusually large illustrations. These are issued from time to time as occasion may demand. The *Bulletin* comprises the shorter papers, those that contain information that it is desirable to issue promptly, and a volume of about 400 pages is issued annually. The scientific papers are distributed, largely in exchange, to museums and libraries throughout the world.

The popular publications include the *Journal*, *Leaflets*, *Guides* and *Handbooks*, and are intended for the information of the general public. The *Journal*, begun in 1900, is the means of promptly inform-

ing the Museum Members of the work of the institution, giving the results of the many expeditions, telling of the collections made, or more important information gathered. It also describes at length interesting or noteworthy installations, and notes the accessions to the various departments, changes in the personnel of the Museum, and elections to Membership. The *Illustrated Guide Leaflets* deal with exhibits of particular interest or importance, such as the Habitat Groups of Birds, the Evolution of the Horse, Meteorites, the Indians of Manhattan, calling attention to important objects on exhibition and giving information in regard to them. The *Handbooks*, the first of which, on the Indians of the Plains, has just been issued, deal with subjects or topics rather than objects. Thus the Plains Indians Handbook, by Dr. Wissler, is not merely a guide to the exhibition hall, but tells of the life and customs of these Indians, their language, political organization, religious beliefs and ceremonies.

The distribution of these popular publications is a part of the educational work of the Museum, as are the exhibits and lectures, and so far they have been necessarily sold below the cost of publication, as is done by other Museums. (*See list at end of this Guide.*)

An important part of the Museum, not seen by the public, is the **Workshops** workshops, located in the basement and provided with machinery of the most improved pattern. Here, among other things, are constructed the various types of cases used in the Museum, including the light, metal-frame case, devised in the institution.

Still other rooms, which, of necessity, are not open to the public, are the laboratories, wherein is carried on the varied work of preparing exhibits, work which calls for the services of a very considerable number of artists and artisans.

Here are cast, modeled, or mounted the figures for the many groups from Man to Myxine, here leaves are made to grow and flowers to bloom as accessories for beasts,* birds and fishes, to say nothing of reptiles and amphibians, and here, with painstaking care, are slowly created in glass and wax the magnified copies of invertebrates.

From all this it may be gathered that a museum is a very busy place, much more so than the casual visitor is apt to imagine. In fact, a very good museum man has said that a museum is much like an iceberg, seven-eighths of it under water and invisible. We will now proceed to the visible eighth.

Before entering the Museum one notices the "Bench Mark" established by the U. S. Geological Survey in 1911 on which is inscribed the latitude and longitude, 40° 46' 47.17" N., 73° 58' 41" W., and height above sea level, 86 feet.

*See Guide Leaflet No. 34

On the right is a "pothole" from Russell, St. Lawrence Co., N. Y., formed by an eddy in the waters of a stream beneath the melting ice of the glacier that covered Northern New York. The stream carried pebbles that, whirled around by the eddy, cut and ground this hole, which is two feet across and four feet deep.

On the left is a large slab of fossiliferous limestone from Kelleys Island in Lake Erie near Sandusky, whose surface has been smoothed, grooved and scratched by the stones and sand in the bottom of the vast moving ice sheet or glacier that covered the northeastern part of North America during the Glacial Epoch. The front of this continental glacier is now thought by most geologists to have retreated northward across Lake Erie from 30,000 to 50,000 years ago. At Kelleys Island the ice was moving from east to west.

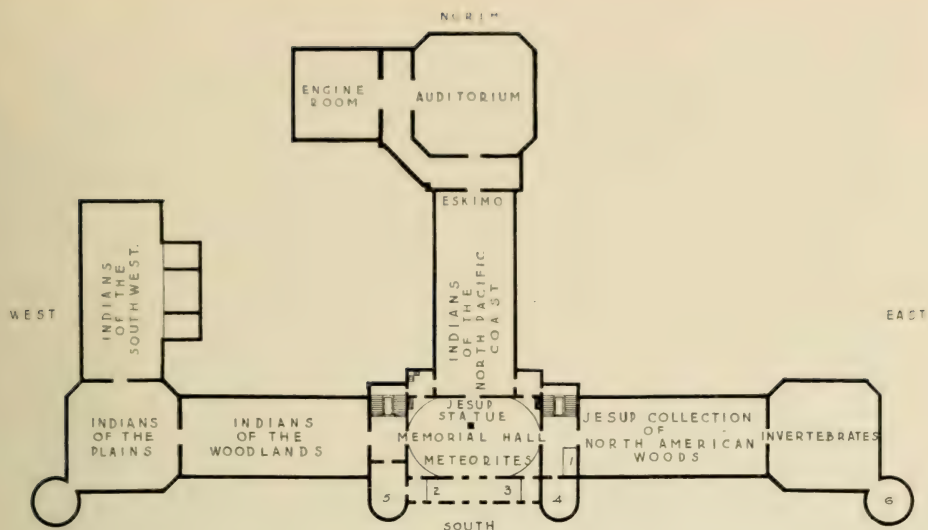


AT THE ENTRANCE TO THE MUSEUM



MEMORIAL STATUE OF MORRIS K. JESUP

Mr. Jesup, President of the American Museum of Natural History for more than a quarter of a century, was a staunch supporter of the institution's two aims, to be a great educational institution for the people and also a center for activity in scientific research



- | | |
|-----------------------|-------------------------|
| 1. Elevators | 4. Academy Room |
| 2. Information Bureau | 5. West Assembly Room |
| 3. Visitors' Room | 6. Collection of Corals |

FIRST FLOOR

SOUTH PAVILION

MEMORIAL HALL

The *Information Bureau* and the *Visitors' Room* are on either side of the south entrance. Wheel chairs for children or adults are available without charge. Postcards, photographs, guide leaflets, and Museum publications of various sorts are for sale, and visitors may arrange to meet friends here. On the right and left of the entrance are small *Assembly Halls* in which lectures to classes from the public schools of the City are given and where the New York Academy of Sciences and other scientific societies hold their meetings.

From the lobby the visitor first enters *Memorial Hall* and faces the marble statue of Morris K. Jesup, third President of the Museum. Mr. Jesup was a founder, trustee and benefactor of the Museum and for twenty-seven years its President. Under his administration and through his liberality the Museum made rapid progress. This statue of Mr. Jesup was executed by William Couper and was presented to the Museum by the Trustees and a few other friends. The marble busts in the wall niches represent noteworthy

pioneers of American science, and are the gift of Morris K. Jesup. These include Benjamin Franklin, statesman and natural philosopher, Alexander von Humboldt, geographer and geologist, Louis Agassiz, zoologist, Joseph Henry, physicist, John James Audubon, ornithologist, Spencer Fullerton Baird, zoologist and founder of the United States Fish Commission, James Dwight Dana, geologist, John Torrey, botanist, Edward Drinker Cope, paleontologist, and Joseph Leidy, anatomist.

Memorial Hall was once the lecture hall and here thousands have listened to Professor Bickmore.

Circling this same hall is a portion of the collection of meteorites, popularly known as "shooting stars," ranging in weight from a few pounds to 36 tons. The greater number of meteorites are stony, but the more interesting ones are composed chiefly of iron, while certain meteorites contain both stone and iron. The toughness of iron meteorites is due to the presence of nickel, and the fact that they were so difficult to cut led to the adoption of an alloy of nickel and iron in making the armor plate for battleships. Meteorites have a very definite structure and when polished (see specimens on the right with electric lamp) show characteristic lines which together with their composition are to the expert absolute proof that the specimens are meteorites.

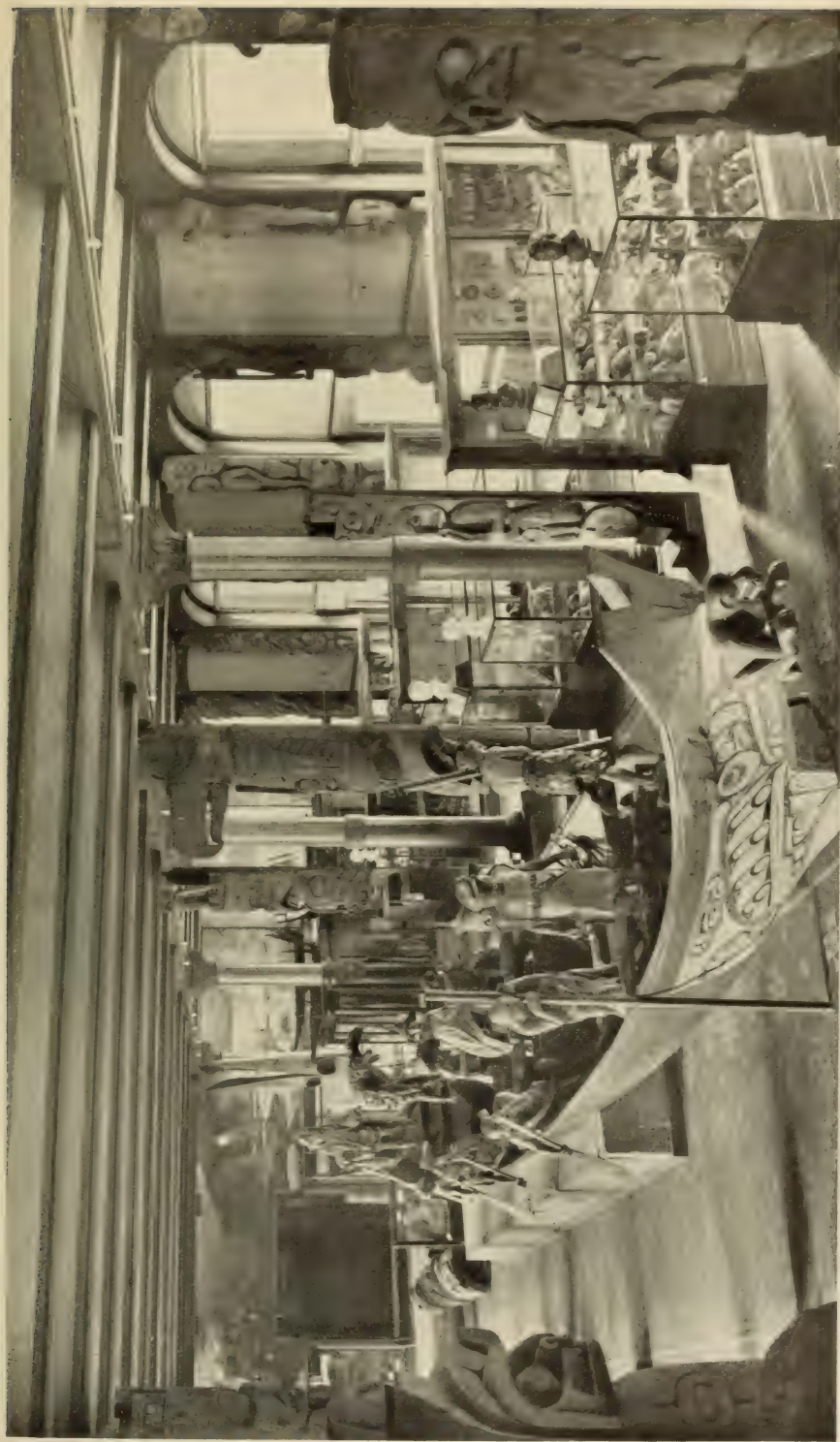
"Ahnighito" or "The Tent" at the left is the largest known meteorite in the world, and was brought from Cape York, Greenland, by Admiral R. E. Peary. It weighs 36 tons, and its transportation to New York was an engineering feat. Opposite it at the right is the curiously pitted "Willamette" meteorite from Oregon which was the subject of a famous lawsuit. The smaller meteorites will be found in the Hall of Geology, fourth floor. [The collection of meteorites is fully described in *Guide Leaflet* No. 26.]

SOUTH CENTRAL WING

INDIANS OF THE NORTH PACIFIC COAST

North of Memorial Hall, that is to the rear of the Jesup statue, is the *North Pacific Hall*, where are displayed collections illustrating the culture of the Indians of the Northwest Coast of America and also of the Eskimo. These collections are arranged geographically so that in passing from south to north through the hall the visitor meets the tribes in the same sequence that he would in traveling up the west coast of North America.

Indians of
British
Columbia and
Alaska



NORTH PACIFIC HALL AND THE CEREMONIAL HAIDA CANOE

This canoe, dug out from a single tree trunk, is 64 1/2 feet long, large enough to contain forty people with their baggage. The canoe was brought to the Museum from the Skeena River, Alaska, in 1883.

The most striking object is the great Haida Canoe in the center of the hall with its party of Chilkat Indians celebrating the rite of the "potlatch." The potlatch is the great "giving ceremony," common to all the coast tribes, when individuals and families gladly impoverish themselves that the dead may be honored, the emblem of the clan exalted and social standing recognized or increased, while underlying the potlatch as a social function is a deep religious fervor in the worship of ancestry and communion with the dead. At the stern of the canoe, which is represented as approaching the beach, stands the chief or "medicine man," who directs the ceremony. The canoe is a huge dugout made from a single tree, is 64 feet long and 8 feet wide and capable of carrying 40 men.

Against the pillars and walls of the hall are many house posts and totem poles with their grotesque carvings; the latter may represent either the coat of arms or family tree, or they may illustrate some story or legend connected with the family. The Haida Indians together with the Tlingit are recognized as superior in art to the other Indian tribes along the Northwest Coast of North America. They are divided into a number of families with various crests for each family and grouped into two main divisions, the Ravens and the Eagles. The Tlingit are makers of the

Chilkat Blankets famous Chilkat blankets, of which the Museum possesses an exceptionally fine collection. Among some of the other tribes there is little wool weaving, the clothing consisting of shredded and softened inner tree bark braided and matted together. The Indians of this region are preëminently a woodworking people, as is manifest in the exhibit. Religious ceremonies and the

Religious Ceremonies wearing of masks generally supposed to aid the shaman or priest in curing disease were customary among most of the tribes. The masks represented guardian spirits and by wearing them the shaman impersonated these spirits.



Modern totem pole at Wrangel, Alaska. Many totem poles are huge cedar carvings so old that the Indians themselves have forgotten their meaning.



CHILKAT BLANKET

The north end of the hall is devoted to Eskimo collections. The cases on the right show the manner of dress, method of transportation, etc., also cooking utensils and bonework. Notice how many of the utensils, weapons and clothing are made from the skin or bone of the seal, walrus and other Arctic animals. The case marked "Eskimo Woman Cooking" shows a section of the interior of a snow hut or igloo lined with sealskin, the mother preparing the food in a primitive stone vessel, heated by flame from seal oil in the stone lamp below. The opposite case shows an Eskimo woman fishing through the ice. She has formed a wind-break with blocks of ice. The fish-rod and hook, and the long ladle are made of bone, and with this latter she keeps the water in the hole from freezing over while she is fishing. In this section will be found collections obtained by the Stefansson-Anderson expedition from the Eskimo of Coronation Gulf, who had never seen a white man.

The mural decorations of Arctic scenery are by Frank Wilbert Stokes, and the legend depicted on the main canvas over the door is given in full in *Guide Leaflet* No. 30; the mural decorations illustrating the industries of British Columbia and Alaska are by Will S. Taylor.

The doorway at the north end of the hall leads to the *Auditorium* which has a seating capacity of 1400, and is equipped with two screens, 25 feet square, for stereopticons. Free public lectures are given here Tuesday and Saturday evenings from October



ESKIMO HOME SCENE

There are two instructive groups near the entrance to the Auditorium and underneath the Stokes Mural paintings of the Land of the Midnight Sun. In one, a home scene within a snow house or "igloo," an Eskimo woman is cooking blubber over the flame from a seal oil lamp, the other represents an Eskimo woman fishing through the ice. The Museum is rich in Eskimo collections.

to May under the auspices of the Board of Education. There are also special lectures for Members of the Museum as well as lectures for school children. At the entrance of the lecture hall is appropriately placed a bust of Professor Albert S. Bickmore, originator of the movement that resulted in the erection of the Museum, first curator, and founder of its lecture system.

In the adjoining corridor is a collection of the principal building stones of the United States, and specimens of petrified wood from the fossil forest of Arizona.

At the end of the corridor is the power room where may be seen demonstrated the transformation of the potential energy of coal into heat, light and motion.

WEST CORRIDOR

To the right or west of the Jesup statue are three halls devoted to Indian collections. To reach these the visitor passes through the *West Corridor* which is devoted to the temporary display of recent acquisitions or small collections of particular interest.

On the landing, at the head of the stairway is the William Demuth collection of pipes and fire-making appliances from many parts of the world.

SOUTHWEST WING

INDIANS OF THE WOODLANDS

The halls to the west contain collections from the North American Indians and together with the hall in the south central wing present the ten great culture areas of North America. (See maps on the south wall.) The hall you now enter represents chiefly the Indians in the Southeastern and Eastern Woodland areas, or all those formerly living east of the Mississippi River. They are, therefore, intimately connected with the early history of the colonies. In the eastern section of this hall, are the New York State Indians of whom the Iroquois are the most important because of their superiority in organization and power.

Indians of the
Woodlands



Carved birch bark kettle of the Penobscot Indians.

The League of the Iroquois, or the Five Nations, comprised the Mohawk, Seneca, Oneida, Onondaga and Cayuga, later the Tuscarora, when it was styled the Six Nations. This league was formed probably as early as 1539 and with the purpose, as its founders boasted, of bringing peace and breaking up the spirit of perpetual warfare. The Oneida Indians were the only members of this league who, as a tribe, adhered to the colonists in the war of the Revolution.

Iroquois

In the wall case on the right are shown the dress, occupations and dwellings of the Iroquois. A life-size model of an Iroquois representing a messenger is holding out a belt of wampum. This wampum, made chiefly of the shells of the "quahog" or common hard clam of our markets, was utilized in various ways: It was greatly prized as an ornament and as trimming on garments; was an important

Wampum



IROQUOIS MASK.*

(Corn and tobacco are our legacies from the Indian.) The matrons of the Iroquois possessed property of their own in distinction to that held by their husbands; they sat in council by themselves and had the right to terminate a war.

feature in religious ceremonies and festivals, being the token by which the Indians confessed and took oaths; and was the object by which public transactions were commemorated. Wampum was not used as currency, however, the Indians having no standard of value until they found it in our currency, but it did come nearer currency than any other kind of property, and when sold to white settlers the strings were counted and reckoned at half a cent a bead. The woman in the right of the case is pounding corn in a primitive mortar.

* The story of this particular false face, with its mouth twisted to one side, is as follows: When Haweniyu had made the earth, he wandered about over its surface contemplating his work. As he went along he met a False-face Being, who rudely demanded what Haweniyu was doing on his earth. The god indignantly replied that he had made the world. This the False-face Being denied, so after more discussion they decided upon a contest. They stood in the middle of a valley, and in order to show his power the False-face Being said, pointing to the mountains at one side, "Do you see those hills over there?" "Yes," replied Haweniyu. "Come here," said the Being to the hills, and immediately the hills came over and stood a few feet away. Haweniyu in his turn addressed not the cliffs but instead said to the False-face Being, "Turn around and see," and the False-face turned, and at the same time the god caused the hills on the other side of the valley to move up so swiftly and so close that they struck the False-face on the side of his countenance and twisted his mouth into the position it has held ever since. The Being then acknowledged the superior power of Haweniyu, and the god said that the False-faces might ever after live at the ends of the earth provided that they would not interfere with the children of men who were soon to be placed in the world. This the False-face Being agreed to with the promise that they would drive away witches and diseases and protect mankind.

On the left is a collection of grotesque masks. These were worn by the False Face Societies. The Indians were very superstitious and believed in the existence of demons or evil spirits who were without bodies, legs or arms, and possessing hideous faces only, were characterized as "false faces." There eventually grew up a society calling itself the "False Face Band" whose members were supposed to have power to counteract the evil done by these demons and to possess the capacity to heal sickness. Pictures by De Cost Smith illustrating this society are on exhibition in the cases.

The earliest Indians of the vicinity of New York City are represented by the archæological collections in the first alcove on the left. Here will be seen remnants of their crude pottery, weapons, cooking utensils, and various implements made of stone, wood or bone, collected chiefly from burial sites on Manhattan Island, Staten Island and Long Island. In one of the cases is a portion of an original dugout canoe which was excavated in Oliver Street in 1906 when a telephone conduit was being laid. This canoe and a large earthen pot are among the very few good specimens that have ever been found representative of New York City Indians.

Among the Delaware collections is a doll that was worshipped by this tribe as the guardian of health. Indians of the vicinity of New York City resemble this tribe more nearly than any other.

In other parts of the hall, in approximate geographical order will be found typical exhibits from the Penobscot, Delaware, Ojibwa, Menomini, Saukteaux, Eastern Cree, Winnebago, and Sauk and Fox of the Eastern Woodland Area, and the Seminole, Cherokee, and Uchee of the Southeastern Area. In the south wall cases are small exhibits from the Mackenzie and Plateau culture areas for which a special hall will be provided in the future. The Seminole have never been entirely conquered. They moved into Florida and have taken up their abode in the Everglades, hostile to the white men whom they will not allow to enter their domain. This exhibit is one of the three existing collections from the Seminole Indians.

Among the Menomini specimens there is an excellent collection of medicine bags, porcupine quill work and a buffalo skin headdress worn by the noted chief Oshkosh. The Menomini have always been friendly to the Americans.

The Ojibway and Menomini are typical Woodland Indians. They made maple sugar, gathered wild rice, worked in birchbark, and practiced a rather complex religion.

At the rear of the hall will be found collections from the Eastern Cree of James Bay and vicinity. While these people live in the woodlands



A MEDICINE MAN'S TIPI, OBTAINED IN MONTANA, 1903

The interior shows the family life of a Blackfoot Indian. The man and women are engaged in household tasks, a tobacco board and pipe are in place for guests; on the family altar some incense may be seen burning as a religious rite. Tipis were originally made of buffalo hide, but this animal, having been practically exterminated, they are now made of duck or cotton cloth. An intermediate stage is shown by the tipi cover of cowhide hanging in the background.



Painted by George Catlin

AN OSAGE CHIEF AND TWO OF HIS WARRIORS

and have a culture of that type, another division of the same people lives in the northeastern corner of the Plains and has a different culture, as may be observed by stepping inside the next hall.

In this, and the adjoining hall will be found many paintings by George Catlin part of a series of four hundred, illustrating the life and ceremonies of the Indian of North and South America. They were presented to the museum by Ogden Mills.

[The Indians of Manhattan and vicinity are described in *Guide Leaflet* No. 29.]

SOUTHWEST PAVILION

INDIANS OF THE PLAINS

The collections of the Indians of the Plains will be found in the hall adjoining. These Indians comprised the tribes living west of the Mississippi and east of the Rocky Mountains as far south as the Valley of the Rio Grande and as far north as the Saskatchewan. They include among others the Plains Cree, Dakota, Crow and Blackfoot shown on the left of the hall, and the Mandan, Pawnee, Kiowa and Cheyenne on the right. Most of these tribes were dependent on the buffalo, so much so that they have sometimes been called the "Buffalo Indians." Buffalo flesh was their

Indians of the
Plains

chief food, and buffalo skin they made into garments. In some cases a buffalo paunch was used for cooking and buffalo horns were made into various implements of industry and war. The spirit of the buffalo was considered a powerful ally and invoked to cure sickness to ward off evil and to give aid in the hunt. Whenever the buffalo herds led the way, the more nomadic Plains tribes moved their tents and followed. With the extermination of the buffalo the entire life of the Plains Indians was revolutionized.

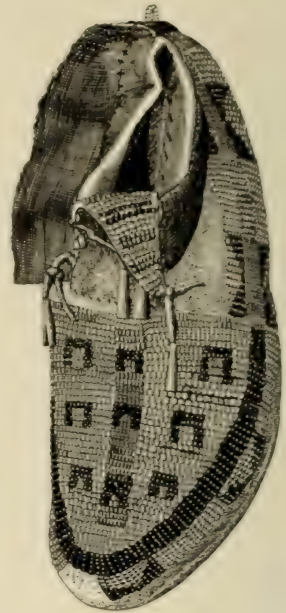
In the center of this hall is a genuine Blackfoot Indian tipi with paintings of otters on the sides. This tipi belonged to a medicine man of that tribe, who claimed to have miraculous assistance from the otter.

There were numerous societies among the Plains Indians which included practically all the adult males. Each society had a special dance and special costumes. There were other dances connected with tribal religious ceremonies, the best known and most important of which is the sun dance illustrated by a model at

the left of the tipi. The sun dance was held annually in the early summer in fulfillment of a vow made during the preceding winter by some member of the tribe who wished a sick relative to recover. The dance involved great physical endurance and excruciating self-torture, lasting three days, during which time the dancers neither ate nor drank.

In the center of the hall is a genuine medicine pipe, held in awe by the Indians and dearly parted with; also the contents of a medicine pipe bundle. The contents of another medicine bundle, belonging to a learned man of the tribe (medicine man), together with the headdress which he wore when visiting the sick, is in a case near the tower.

The Plains Indians are noted for their picture writing on skins and for their quillwork which has now been superseded by beadwork. They have a highly developed decorative art in which simple geometric designs are the elements of composition, this being one of the most interesting features of their art. [See *Handbook* No. 1. North American Indians of the Plains.]



A beaded moccasin from the Indians of the Plains (Gros Ventre).

WEST WING

INDIANS OF THE SOUTHWEST

On the left are collections from the sedentary Indians who occupy the pueblos of the Rio Grande and of Hopi, Acoma and Pueblo Indians Zuñi; and also the objects recovered from the prehistoric pueblos, caves, and cliff-dwellings; on the right are the nomadic Indians—the eastern and western Apache, the Navajo, the Pima, the Papago, and several tribes of northern Mexico. In the south annex will be found baskets from the Indians of California.

The sedentary Indians live in large community houses often with several receding stories, built of stone or adobe. They depend chiefly upon agriculture for their food, make a variety of pottery, and have many elaborate religious ceremonies. The nomadic peoples live in tipis or small brush and thatched houses which are moved or deserted when they are forced to seek the wild game and wild vegetable products which furnish much of their food. They make baskets for household purposes which are more easily transported than pots. There are models in the hall of the pueblos of Taos and Acoma, of prehistoric cliff-dwellings and of the houses used by the Navajo and Apache.

The upright cases of the next alcove are filled with wonderful prehistoric pottery. That in the wall case is from Pueblo Bonito. Similar gray and white ware with very elaborate and splendidly executed designs in an adjoining case are from Rio Tularosa, one of the upper tributaries of the Gila, where a vanished agricultural people once lived in pueblos and cliff-dwellings. A third case has pottery from the Casas Grandes of Chihuahua, Mexico, and represents the southern limit of the southwestern ancient culture. In the table case and in a case standing in the aisle are shown the wonderful art work in turquoise, shell, stone and wood of the former inhabitants of Chaco Cañon. These objects, as well as the pottery from Pueblo Bonito mentioned above, were secured by the Hyde Expedition.

In the next alcove, devoted to the Hopi, are the costumes, masks, images, and plaques used in their ceremonies. Besides the well-known snake dance, the various Hopi villages have many interesting ceremonies, many of which are concerned with the rainfall and their crops.

The inhabitants of Zuñi are believed to be the descendants of the first people seen by the Spanish in 1540. Their former villages, many of which are now in ruins, were probably the "Seven Cities of Cibola," for which Coronado was searching at that time. Although they had missionaries among them for about three centuries, they have retained

many of their own religious ceremonies. In the first upright case the woven costumes of Acoma are shown and pottery from that pueblo. In the last cases on this side of the hall are examples of Zuñi pottery, both ancient and modern.

The Pima, next in order in the hall, practiced irrigation, raising by its aid the corn and beans on which they relied for food and the cotton which they used for their scanty garments. The Papago, with whom they are closely associated, occupied the more arid portions of southern Arizona and northern Sonora, securing their living from such desert products as the giant cactus, the century plant, the yucca and the mesquite and small game. Examples of their food, baskets, pots, and ceremonial articles are shown.

The Western Apache live in thatched houses, an example of which stands at the further end of the hall. They occupy the upper portion of the Gila and Salt rivers where they practice agriculture, gather the wild products and hunt. These were the people who, under Geronimo, raided the settlements of southern Arizona and Northern Mexico and evaded our troops for years. A portion of them in recent years have developed a new religion the chief symbols of which are the cross, standing for the hoped for world, and a crescent, representing the moon about which the cult centers. These symbols occur on very many of the objects here exhibited.

The Eastern Apache lived in buffalo skin tipis. They went far out on the plains in search of the buffalo herds, avoiding, if possible, the plains tribes, but fighting them with vigor when necessary. In dress and outward life they resemble the plains Indians, but in their myths and ceremonies they are like their southwestern relatives and neighbors. The baskets of both divisions of the Apache are shown in the large end case which is in contrast with the corresponding case on the other side of the hall. Not the environment but social habits caused one people to develop pottery and the other to make the easily transported and not easily breakable baskets.

The Navajo, a large and widely scattered tribe, inhabit much of the country drained by the San Juan and Little Colorado rivers. During the winter they occupy houses like the one standing in the large annex; but in milder weather, camp with the slight shelter of a cliff or a wind break and shade made of brush. They live by raising corn in the moist valley and on the flesh of their numerous flocks of sheep.

They are the present-day blanket makers of North America. They make use of the wool of the sheep they raise, carding, spinning, and weaving it by means of the simplest implements and looms. This art is believed to have arisen since the coming of the Spanish and it is known to have passed through several stages in the last sixty years. The



An attractive Navajo blanket from the Museum's valuable collection. The Navajo Indians of the Southwest are a wealthy pastoral people, and the best Indian blanket makers of North America.

older types of blanket here shown contain yarn which was obtained by cutting or ravelling from imported flannels called in Spanish, bayeta, from which the blankets of this sort receive their name. These are either bright red or old rose in color, resulting from cochineal dye. Several blankets are made of yarn bought ready dyed from the traders and are called Germantowns. The greater number, however, contain yarn of native spinning, dyed with native vegetable and mineral dyes.

The Navajo are also expert silversmiths. Their tools and samples of workmanship are displayed in a case in the center of the hall.

[*Return to the Jesup Statue.*]

EAST CORRIDOR

POLAR MAPS

Leaving the statue on the left and "Willamette" meteorite on the right and going east the visitor enters the corridor where the elevators



WILD PLUM IN THE FORESTRY HALL

Each of the five hundred species of trees in North America is represented by a section of trunk five feet long, some of a diameter not found in the country's forests to-day. Many of the specimens are accompanied by wax models of leaves, flowers and fruits accurately reproduced from life.

are located (*East Corridor*). Here will be found maps of the north and south polar regions showing the routes of explorers. On the wall by the north polar map are the sledges used by Admiral Peary in his last three expeditions in search of the North Pole. The Morris K. Jesup sledge which the Admiral used in his successful polar expedition is the one nearest the entrance. The various sledges in their differences of style show the persistent effort made by Admiral Peary to bring the sledge up to its greatest possible usefulness. That he was successful on his last trip was in part due to the final modification.

On the opposite side of the doorway is one of the sledges used by Amundsen on his journey to the South Pole. [A history of south polar expeditions is given in *Guide Leaflet* No. 31.]

In a room at the north end of this corridor is the large Mainka seismograph, for recording the occurrence of earthquakes. This was given to the New York Academy of Sciences by Emerson McMillin, and by the Academy deposited in the Museum.

SOUTHEAST WING

JESUP COLLECTION OF NORTH AMERICAN WOODS

To the east of the elevators is the *Hall of North American Forestry* containing the Jesup Collection of North American Woods, a nearly complete collection of the native trees north of Mexico, presented to the Museum by Morris K. Jesup. On the right is a bronze tablet, by J. E. Fraser, the gift of J. J. Clancy, depicting Mr. Jesup as he walked in his favorite wood at Lenox, Mass.

To the left is a section of one of the Big Trees of California, sixteen feet in diameter and 1341 years old. It began its growth in the year 550, so that it was nearly a thousand years old before America was even discovered. The specimens show cross, longitudinal and oblique sections of the wood finished and unfinished, and the labels on the specimens give the distribution of the species, the characteristics of the wood and its economic uses. The trees are grouped by families and the location of each family will be found on the floor plan at the entrance of the hall. The reproductions of the flowers, leaves and fruits in natural size are instructive. This work is done in the Museum laboratories. Note the character of forests as shown by the transparencies. [For fuller information in regard to this hall see *Guide Leaflet* No. 32.]



A PART OF THE WHARF PILE GROUP

SOUTHEAST PAVILION

INVERTEBRATES

At the extreme east is *Darwin Hall*, devoted chiefly to the invertebrate animals (those which do not possess a backbone). Facing the entrance is a bronze bust of Darwin by Wm. Couper presented by the

Synoptic Series New York Academy of Sciences on the occasion of the Darwin centenary in 1909. Passing around the hall

from left to right, the progression is from the lowest forms of animal life, the one-celled Protozoa, to the highest and most complex forms of animal life, the Primates, including man. The distinctive characteristics of each group are fully described on the alcove and case labels. Many of the minute forms are represented by skilfully prepared models in glass and wax showing the animal many times enlarged. Thus the visitor may obtain an idea of the form and structure of these animals which in spite of their small size have in so many instances such a vital influence on the life of man.

This alcove contains the lowest forms of animal life. All are single-celled individuals. The simplest kinds are abundant in swamps and stagnant water, others are found in myriads in the sea while the ocean

Alcove 1 bottom
Protozoa in many
localities
is covered with
them. The speci-
mens exhibited in
this alcove are
models, some of
which are enlarged
more than a thou-
sand diameters.

Sponges are principally of two kinds—those with skeletons or supporting structures of silica (i. e. flint) and those

Alcove 2 with skel-
Sponges etons of
horn. The



European commercial sponge comparable with the Florida yellow sponge or "Hardhead." The sponge industry in both the Mediterranean and the Bahama region is almost destroyed by careless methods, and conservation must be practiced here as in other of the world's resources.

sponges of commerce belong to the latter class. In the specimens exhibited the skeleton only can be seen, the living tissue having been removed.



Marine Habitat Group. A community of starfishes, sea anemones, sea urchins, corals and sponges as seen below the edge of a coral reef in the Bahamas.

Many of the "glass" sponges are very beautiful in design. Sponges range in size from the tiny *Grantia* of the New England coast to the gigantic "Neptune's goblets" found in the eastern seas. This alcove contains certain specimens whose tissue is represented in wax tinted to show the natural coloring of sponges, which varies from the bleached yellowish color commonly seen to deep brown or black, or yellow and red, in varying shades.

In Alcove 3 are shown coral animals and their relatives: plant-like hydroids which often are mistaken for sea moss, but which really are a series of polyps living in a colony; jellyfishes with their umbrella-shaped bodies and long streaming tentacles; brilliant colored sea anemones, sea fans and sea plumes; the magenta colored organ-pipe coral, the stony corals, and the precious coral of commerce. Coral polyps are the animals that build up the coral reefs (there is no coral "insect").

The best known species in this group is the tapeworm, whose development and structure are accurately shown by the models in the central case. As will be seen, its structure is more complex than that of preceding forms.

Alcove 4
Flatworms

Alcove 5
Roundworms

These are for the most part parasitic, living in the digestive canals of mammals. The most familiar is the common roundworm or stomach worm, *Ascaris*, of which an enlarged model is exhibited.

The minute wheel animalcules comprise many exquisite and grotesque forms, some of which construct tubes of gelatinous substance, sand-grains, etc. A few of the species are parasites, but most of them live a free, active life. They are aquatic and mainly found in fresh water.

Alcove 6
Rotifers

The sea-mats in Alcove 7 are plant-like animals which lead the colonial form of life. The majority of the species are marine, although a few occur in fresh water. The lamp shells shown in this alcove superficially resemble clams, but by structure are more closely related to the worms and starfishes.

Alcove 7
Sea-mats

Alcove 8 is occupied by the starfishes, the sea urchins, sea cucumbers and sea lilies. The starfish is the pest of the oyster beds as it feeds on oysters and destroys them in large numbers. The brittle stars when handled or attacked are able to drop off an arm and later regenerate another. Sea urchins are an important article of food in Europe and the West Indies.

Alcove 8
Starfish

The annelids, typified by the familiar earthworm, are worms whose bodies are made up of rings or segments. They are inhabitants of both fresh and salt water, many kinds living in the mud and sand of the shore while others bore into wood and shells. The "houses" that these annelids build are often very beautiful and interesting. In the window is a group showing a section of a mud flat on the New England coast with the variety of worm life found in what to the casual observer seems to be an uninhabited area.

Alcove 9
Annelids

Arthropods include the familiar crabs, lobsters, insects and their relatives. The number of existing species in this group is greater than that of all the rest of the animal and vegetable kingdoms together. No other group comprises so many species useful or harmful to man. In the case in the center of the alcove is a model showing the anatomy of the common

Alcove 10
Arthropods

Crustaceans
and Insects

lobster, also enlarged models showing heads of various species of insects. On the wall are two of the largest specimens of lobsters that have ever been taken. They weighed when alive thirty-one and thirty-four pounds respectively. The largest of the arthropods is the giant crab of Japan, some of which, like that placed on the wall, have a spread of about ten feet.

The mollusks form a group second only to the arthropods in the vast number and diversity of forms which it embraces, including marine, fresh water and land animals. All mollusks have soft

bodies, but nearly all of them secrete a shell which in many species is of pearly material (mother-of-pearl). Well-known examples of this group are the common clam and oyster and enlarged models in the center case show the anatomy of these species. The largest species is the huge "bear's paw" or furbelowed clam of the eastern seas.

Alcove 11
Mollusks

Model of
Clam and
Oyster

Vertebrates include the largest, most powerful and most intelligent of animals. This group culminates in man who still bears witness to his chordate ancestry in the retention of a chorda (cartilaginous spine), and gill clefts during embryonic life.

Alcove 12
Vertebrates

Among these ancestral forms are the Ascidians, or Sea-squirts, an enlarged model of which is shown in the central case, while others are shown among the animals on the wharf-piles in the window group. The models in the central case show the development of the egg of typical vertebrates.

An exceptionally large specimen of beautiful madreporé coral is in the case near the entrance, and the associations of marine life that may be found among the coral reefs of the Bahamas are represented by several small groups in the center of the hall.

Coral

Certain of the groups in this section of the hall illustrate various biological principles associated with the name of Darwin. The variation in form, size and color of the snail and the variation of the shell of the common scallop are graphically shown.

Four large models in the center of the hall show the mosquito which is the cause of the spread of malaria. These models represent the insect enlarged seventy-five diameters or in volume four hundred thousand times the natural size. The mosquito in its development undergoes a metamorphosis. The model at the left shows the aquatic larval stage; the larvæ are the "wrigglers" of our rain water barrels. The next model is the pupal stage, also aquatic. The third model is of the adult male mosquito which is harmless since it never bites man. The fourth model shows the adult female mosquito in the attitude of biting. In another case is a series of models showing the life cycle of the malarial germ in the blood of man and in the mosquito.

Models of
the Malarial
Mosquito

In several of the alcove windows are habitat groups of invertebrates illustrating the natural history of the commoner and more typical animals.

Window
Groups

In the Annulate Alcove is shown the Marine Worm Group reproducing these animals with their associates in their natural surroundings, as seen in the harbor of Woods Hole, Mass. The harbor and the distant view of Woods Hole village with the U. S. Fish Commission buildings are shown in the background, represented

by an enlarged colored photographic transparency. In the foreground the shallow water of the harbor near the shore is represented in section to expose the animal life found on muddy bottoms among the eel-grass, as well as the chimneys of various worm-burrows. In the lower part of the group a section of the sea bottom exposes the worms within the burrows. Several species of these are represented.

In the Mollusk Alcove window is shown the natural history of a sand-spit at Cold Spring Harbor, Long Island, including some of the shore mollusks and their associates. The entrance of the harbor is seen in the distance. In the foreground at the edge of the sand-spit a mussel-bed is exposed by the receding tide over which fiddler-crabs are swarming into their burrows. Beneath the water surface an oyster is being attacked by a star-fish, while crabs and mollusks of various species are pursuing their usual activities.

The window group in the Vertebrate Alcove shows the piles of an old wharf at Vineyard Haven, Mass. Below the low-tide mark the submerged piles are covered with flower-like colonies of invertebrate animals. Among these are sea-anemones, tube building worms, hydroids, mussels, sea-mats and several kind of ascidians or sea-squirts. The latter are primitive members of the Chordate group which includes the vertebrates. Like the embryo of man, they possess during their larval period a chorda or cartilaginous spine. At first they are free swimming but later in life many of their organs degenerate and they become fitted to a stationary mode of life.

Other exhibits illustrate certain facts made clear by Darwin. On the right and left of the entrance variation under domestication is illustrated by dogs, pigeons, and domesticated fowls, the wild species from which they have been derived being shown in company with some of the more striking breeds derived from them.

The struggle for existence is portrayed by the meadow mouse, surrounded by its many enemies and yet continuing to maintain an existence by virtue of its great birth rate.

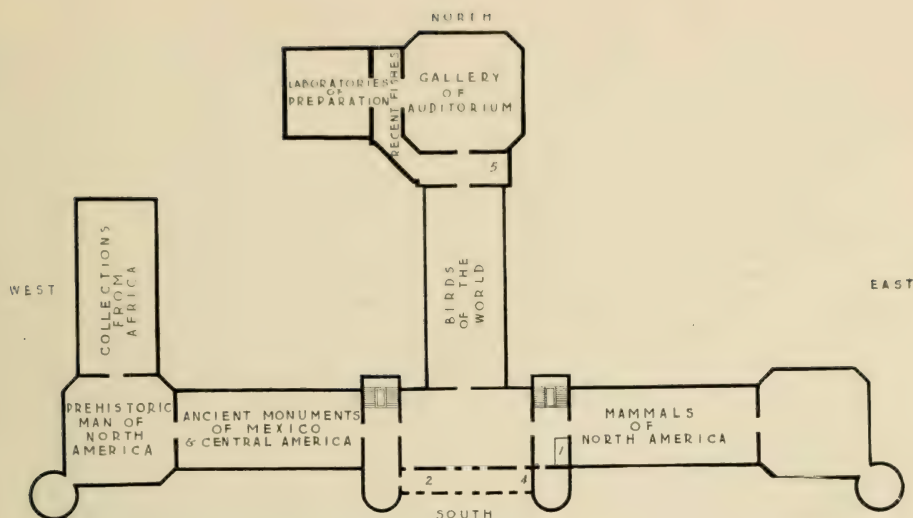
[Return to the elevators.]



A PORTION OF THE BULLFROG GROUP

Two frogs are engrossed in a chickadee on the birch branch above. The smaller frog seems likely to fall a prey to a black snake ready to strike from the white azalea near.

The scene is typical of Southern New England in July. The frogs and the reptiles are wax casts from life. The various activities of bullfrog life are set forth, with their relation to birds and small mammals, fish, snakes, turtles, insects and snails. The metamorphosis from the tadpole is also shown.



1. Elevators
2. Children's Room
4. Natural History Reading Room

SECOND FLOOR

SOUTH PAVILION

This hall illustrates a phase of Museum progress, the temporary disorder that precedes an ultimate change for the better. At present the hall contains a mixed assemblage of animals brought hither from other halls in process of re-arrangement; later it is hoped that it will contain a series of groups of birds from various parts of the world.

The Asiatic elephant is the famous "Tip" brought to this country in 1881, and for seven years one of the attractions of Forepaugh's circus. He was given to the City of New York by Mr. Forepaugh and lived in the Central Park Menagerie until 1894, when because of his treacherous disposition it was found necessary to kill him. He is said to have caused the death of several of his keepers, and was twenty-three years old when killed.

Here, awaiting the construction of a new wing is exhibited the collection of reptiles and amphibians. Because of the difficulty of preserving the natural covering of many of these animals they are usually exhibited in jars of alcohol. In the specimens on exhibition here the perishable parts have been cast

in wax from life; for example in the star tortoise the original "shells" of the specimens are used, while the head, neck and legs are restored in wax. The mounting not only brings out the principal features of the species exhibited, but in many instances illustrates also some distinctive habit of the animals; for instance the common newt, one of the salamanders, is represented by a series of five life-size casts showing the process of shedding the skin; Pickering's hyla or the "spring peeper" is shown with vocal sacs inflated; the poisonous bushmaster is represented with its eggs, and so on.

The classification of these animals is shown in the cases along the walls; the groups in the center of the hall represent various reptiles as they appear in their natural haunts. They include the tuberculated iguana, the water moccasin, the diamond-backed rattlesnake, the Texas rattlesnake, the copperhead, the Gila monster, the pine snake, the box tortoise and the common painted turtle.

One of the most interesting of the groups is a jungle scene in India showing a water monitor,

Cobra Group which is the largest of living lizards, the poisonous Russell's viper and the deadly spectacled cobra, the last with hood distended and poised ready to strike. The cobra is said to be the cause of a great majority of the 20,000 deaths which annually occur in India from snake bite. Examine carefully the group of the copperhead snake or "red-eye,"

Copperhead Snake Group one of the two species of poisonous



BULLFROG GROUP

The bullfrog's tongue is fastened in front and the free hinder end can be thrown far out of the mouth to capture insects

snakes to be found in the vicinity of New York and also the group contrasting the harmless water snake with the poisonous water moccasin of southern cypress swamps. Two groups are devoted to rattlesnakes, which are easily recognized by the string of rattles at the end of the tail, by means of which they give warning before they strike. There are comparatively few species of poisonous snakes in the United States, about sixteen in all, comprising rattlesnakes, the moccasin, copperhead and two kinds of coral snake. All other species are harmless and in spite of the almost universal prejudice against them are a

very useful ally of man since they live chiefly on rats, mice and insects injurious to crops.

Entering the darkened room near by we find a group of unusual **Bullfrog** interest, showing the common bullfrog of North **Group** America.

This group is a study of the bullfrog undisturbed in its typical haunt. It illustrates the changes from the tadpole to the adult frog and shows many of the activities of the frog—its molting, swimming, breathing under water and in air, croaking, and “lying low” before an enemy; also its food habits in relation to small mammals, to birds, snakes, insects, snails, to small fish and turtles.

Another group is the Great Salamander or Hellbender, best known in the creeks of western Pennsylvania. The group pictures them at breeding time, and shows their characteristic stages and habits: thus one of the salamanders is pictured molting, another, a male, is brooding a great mass of eggs; and the group explains many details of their manner of living.

To the left as we approach from the elevator are the Natural History Reading Room and the Children’s Room.

In the Natural History Reading Room are placed popular books on natural history and especially books descriptive of the collections in the exhibition halls. The visitor is invited to make use of these books. The main library consisting of more than 70,000 volumes on natural science, is on the fifth floor, open free to the public from 9 A. M. to 5 P. M. daily, except Sundays and holidays.

The Children’s Room is designed to arouse interest in natural history and outdoor life. Its low cases contain exhibits for the little folks, based on the maxim that knowledge begins in wonder, and showing curious fishes, quaint dolls from various parts of the world and other objects calculated to attract children and lead them to ask why and what for.

Near the entrance to the Children’s Room is a bronze tablet in memory of Jonathan Thorne, whose bequest provides for lectures and objects for the instruction of the blind.



THE AMERICAN ROBIN—ONE OF THE GROUPS OF LOCAL BIRDS

WEST CORRIDOR

LOCAL BIRDS

Adjoining the *South Pavilion* is the *West Corridor* which contains the collections of local birds.

In this room are specimens of all the varieties of birds which have been known to occur within fifty miles of New York City. As far as possible each species is shown in all its different plumages. In the wall cases nearest the entrance on both sides is the *General Collection* of all birds likely to be seen within this area, arranged according to the current American system of classification. Near the windows are cases containing the *Seasonal Collection*, one section containing the permanent residents while others have their contents changed each month so that they may show always the birds present at the time. In another section are the stragglers from other parts of the country and from other countries which have been taken within our limits.

Besides the table case containing the eggs (often with the nest) of species known to nest within fifty miles of the City and the collection of photographs showing many of them in nature, there are



A room of the Museum's Mexican Restaurant, an accurate restoration of temple ruins at Mitla.

down the middle of the room a series of groups of local breeding birds with their nests. These, the forerunners of our "Habitat Groups," were the first of their kind made for the Museum. [See *Guide Leaflet* No. 22.]

SOUTHWEST WING

ANCIENT MONUMENTS OF MEXICO AND CENTRAL AMERICA

Continuing west, past the collection of local birds we enter the *Southwest Wing*, devoted to ancient monuments of Mexico and Central America. The reproductions illustrate chiefly the sculptures of the Maya and Nahua Indians made before the time of Columbus and are the gift of the Duke of Loubat.

At the left of the entrance are cases of pottery, jade and heavy stone work from Panama, Costa Rica and Nicaragua. For skill in free hand modeling and painting the pottery ranks high.

Opposite this exhibit are examples of original stone sculptures of the
Maya Art Maya, mostly excavated at Copan in Western Honduras. Beautiful pottery and finely wrought jades are also shown from other sites. The Maya were perhaps the most highly civilized people in the New World. They built many cities of stone and erected many fine pillar-like sculptures which are called stelæ. The subject-



HALL OF MEXICAN AND CENTRAL AMERICAN ARCHAEOLOGY

A collection comprising many casts of ancient stelæ, or monuments carved from volcanic stone, and probably commemorating events in pre-Columbian times; also codices or chartlike books that later replaced the stelæ as records; casts of sacrificial stones; pottery and figures worked in clay; and many objects in jade, gold and copper.

matter on these monuments deals with priest-like beings who carry serpents and other ceremonial objects in their hands. There are also long hieroglyphic inscriptions containing dates in the wonderful Maya calendar. Maya history contains two brilliant periods. That of the south, extending from 160 A.D. to 600 A.D., was chiefly remarkable for its sculptures. The principal cities were Copan, Quirigua, Tikal, Yaxchilan and Palenque. The second period fell between 950 A.D., and 1250 A.D., and centered in northern Yucatan. The chief cities were Chichen Itza, Uxmal and Labua, and the finest works of art were architectural.

Passing to the end of the hall and then returning toward the east entrance, we see, on either side of the aisle, reproductions of the stelæ and altars of Copan arranged in order from the oldest and crudest forms to the latest and finest examples of carving, covering a stretch of nearly 300 years. The early stelæ have hieroglyphs carved in very low relief and with sharp corners, while the hieroglyphs on the later monuments are cut deeper and in more rounded relief. In the early stelæ human figures are carved in an awkward block-like manner, with protruding eyes and angular limbs. The two lofty stelæ in the center are from Quirigua and date from about 550 A.D. From this city also comes the elaborately sculptured boulder that may have served as an altar. It represents a two-headed monster overlaid with several layers of ornament. Sculpture from Palenque and other cities are also shown.

The second or architectural period of Maya art is exemplified in the copy of the painted sculptures of the Temple of the Jaguars at Chichen Itza. Here are shown warriors in procession who seem to be coming to worship a serpent god. Prayers are represented as coming from their lips. This sculpture shows strong evidence of Mexican influence in certain of its details.

Next in order is the Nahua culture represented in the alcove cases by ancient pottery, musical instruments, copper objects and ornaments of obsidian and jade. One case contains facsimile reproductions of native books, called codices, which were painted free hand on strips of deerskin, paper or cloth. Several original documents are also exhibited. The Spaniards, in their zeal to destroy the native religion, burned hundreds of these books which recorded ceremonial rites and historical events by means of pictures and hieroglyphs. The Nahua culture extended through many centuries and the remains, such as pottery, are found deposited in distinct layers, one above the other. In the valley of Mexico there are three so-called culture horizons, the last being that of the Aztecs. There is no good reason to believe that any connection in art or religion existed between Mexico and any part of the Old World.

The Aztecs founded their capital city, called Tenochtittan (Mexico City), in the year 1325, and had a short but brilliant history. Before the arrival of Cortez, in 1519, they had reduced most of the provinces of Central Mexico. The sacrificial stone, or Stone of Tizoc, is a record of some of their principal conquests made before 1487. The Calendar Stone is a graphic representation of the four prehistoric creations and destructions of the world as well as symbol of the sun and a record of the divisions of the year.

The statue of Coatlicue, the mother of the two principal Aztec gods, is a curious figure, made up of serpents. All three sculptures were originally in the Great Temple enclosure and are now in the Mexican National Museum.

The funeral urns of this region are highly conventionalized figures. A cruciform tomb at Guiaroo, near the ruins of Mitla, is shown by a model at this end of the room.

SOUTHWEST PAVILION

PREHISTORIC MAN OF NORTH AMERICA

Continuing west we pass into the *Southwest Pavilion* likewise given over to archæology, in this instance that of North America. Here are examples of ancient pottery, arrow-heads, stone axes and other implements of stone and bone, mostly from burial mounds. The most important of these are the rude implements and fragments of human bones from the Trenton gravels, as these are the oldest indubitable evidences of man on this continent. Notice that the arrangement from left to right around the hall is by states. Read the label at the entrance of this hall. For more complete description read case labels and various books of information on the exhibits in this room.

In the tower room adjoining are the stone implements and rude carvings of the primitive men who inhabited the caves of Southern Europe at a time when England was a peninsula, the north of Europe buried deep under the ice of a glacial epoch and the reindeer and the hairy mammoth roamed through Southern France.

Around the room are copies of paintings—for primitive man was an artist as well as a hunter—on the walls of the caves of Altamira, Font de Gaume, and others, showing the Bison, wrongly called Aurochs, the mammoth and the horse of that day, the contemporaries of the *Neanderthal* man.

At the entrance is a time clock from which it appears that if the age of the world be taken as representing 60,000,000 years, the historic period with which we are acquainted has lasted half a second.



WEST WING

COLLECTIONS FROM AFRICA

Opening to the north from this hall of North American Archaeology is the African Hall. This differs from other halls in containing besides ethnographical specimens a number of characteristic African mammals. The future extension of the Museum will provide room for groups of African mammals, including elephants. The installation is geographical, i. e., as the visitor proceeds through the hall from south to north he meets the tribes that would be found in passing from south to north of Africa, and the west coast is represented along the west wall, the east coast along the east wall.

The hippopotamus is the famous "Caliph," who lived for twenty years in the Central Park Zoo and died when nearly forty years old. He was the largest hippopotamus ever recorded.

The central portion of the hall is given over to the anthropology of the Congo, the collections being largely the gift of Leopold II. of Belgium. The decorative frieze is designed to give an idea of the character of the country and again the arrangement of the panels is geographical. The window transparencies show scenes of the daily life of the people, the thatched houses in which they live, the games they play and the clothes they wear. The South African negro is essentially an agriculturist; both men and women plant and hoe. Maize, millet, rice, beans, sweet potatoes and pumpkins are among the products.

Hunting is no longer common, although among some of the tribes they set traps for leopards and lions and hunt the hippopotamus. In one tribe fishing is accomplished by putting poison into the water to stupefy the fish which are then gathered in the hands by hundreds.

These primitive people of the Congo display remarkable skill in working iron, as an examination of their weapons of war and of the chase will show. Wood-carving, weaving, and spinning are done by the men; pottery is made by the women. Musical instruments are numerous. An exhibition of bronze and brass castings, a craft among the Benin and unheard of before 1897, is in the north end of the hall. Many of these bronzes portray cultural traits. This method of casting was employed in Europe in the Renaissance period. How old the art may be and how much of it is really native is a question.

Bark cloth, shown in some of the cases, is used for bed mats and clothing. In the case at the south end of the Congo collections are a number



MULANDI CARVED STICKS, AFRICA

Wood carving is a highly developed art in South-central Africa and the Congo. The carving on these knob-sticks represents great power of finish and execution.

of so-called "pile blankets" which the men weave and the women decorate.

The countless number of knives, spears and warlike implements is suggestive of the manner in which these people live; they are never certain of not being attacked. They make few permanent things and store up little food in time of plenty.

Fetish worship is common. Some of these fetishes are supposed to give security in battle or to ward off ills. The ceremonial masks of which a great number are on exhibition, are owned and worn mostly by the shamans or priests. Ancestor worship is found among some tribes.

[Return to the elevators.]



THE PTARMIGAN IN WINTER

One of a series of four small groups showing this bird's seasonal changes of color as brought about by molting and feather growth.

SOUTH CENTRAL WING

BIRDS OF THE WORLD

Going north we enter the hall containing the general collection of birds. In the first four main cases on the right the 13,000 known species are represented by typical examples of the principal groups arranged according to what is believed to be their natural relationships. The series begins with the Ostriches, the "lowest" birds (that is, those which seem to have changed least from their reptilian ancestors) and goes up to those which show the highest type of development, the Singing Perching Birds such as our Thrushes and Finches. The remaining cases on the right wall and all of those on the left show the geographical distribution of the bird fauna of the world. The specimens are grouped according to their great faunal regions, the South American Temperate, American Tropical, North American Temperate, Arctic Eurasian, Indo-Malay, African and Australian realms. These cases in connection with the accompanying maps give opportunity for a comparative study of the birds of the different parts of the world. In each region, as in the Synoptic Collection, the birds are arranged in their natural groups to the best of our present knowledge.

Birds of
the World



LABRADOR DUCKS. NOW EXTINCT

From the Group in the American Museum

Down the middle of the hall near the entrance are several cases containing birds which have become extinct or nearly so. **Extinct Birds** The Labrador Duck, once a common winter visitor to our Long Island shores, became extinct for no known reason. The Great Auk and the Dodo were flightless species which bred in great numbers on small islands and were easily and quickly killed off by men. The Passenger Pigeon of North America lived by the million in such dense flocks that vast numbers were slaughtered with ease, so that now (1913) the *only individual left alive* is an aged female in the Cincinnati Zoölogical Gardens. The Heath Hen formerly had a good range on our Atlantic seaboard, but as a game bird, it was so continually persecuted, in and out of the breeding season, that it is now extinct except for a few which survive under protection on the island of Martha's Vineyard. Others of our splendid game birds, such as the Trumpeter Swan and Eskimo Curlew, are nearly, if not quite gone, and more like the Wood Duck and Wild Turkey, will soon follow them if a reasonable close season and limited bag be not rigidly enforced. Still others—the beautiful Egrets and the Grebes, for example—have already gone far on the same road owing to the great demand for their plumage for millinery purposes.

Also down the center of the hall are several cases designed to illustrate the general natural history of birds.

The widely different plumages (varying with age, sex, season, or all three) often worn by one species will be found illustrated **General Topics** in the Ptarmigan case and in the case containing Orchard Orioles, Snow Buntings, Scarlet Tanagers and Bobolinks. The relationship between structure and habits, the many forms of bill, feet, wings, tail, etc., and the different ways of using them are illustrated in other cases, particularly by one showing the feeding habits of some birds.

In the alcoves to the right the first egg case contains the Synoptic
Eggs Collection of Eggs which shows the variation in the number in a set, size, shell texture, markings, shape, etc., and tells something of the laws governing these things. The succeeding cases contain the general exhibition collection of nests and eggs, principally those of North American and of European birds.

At the north end of the hall is a nearly complete collection of the
Birds of Paradise Birds of Paradise, presented by Mrs. Frank K. Sturgis. This family of birds is confined to New Guinea, Australia and some neighboring islands. Their feet and bills show their close relationship to the Crows and Jays, which they resemble in nesting habits as well. Their chief characteristic is of course their gorgeous plumes, wonderful as well in variety of form and position as in beauty. For these plumes the birds are still being killed in such large numbers that unless the demand for them soon ceases all the finer species will be exterminated, as the Great Bird of Paradise is believed to be already. More Birds of Paradise have been sold at a single London auction (23,000 in two sales) than are contained in all the museums of the world.

Also in this hall are a number of groups of local and other birds which are placed here only temporarily. In fact, much of the arrangement of the hall will be changed as soon as circumstances permit.

Finback Whale Suspended from the ceiling is the skeleton of a Finback Whale, sixty-two feet in length.

CORRIDOR OF CENTRAL PAVILION

RECENT FISHES

The doorway at the north end of the hall of the birds of the world leading to the rear of the bird of paradise case opens into the gallery of the *Auditorium* and to the corridor devoted to the general collection of recent fishes.

The exhibit includes typical examples of the various groups of back-boned animals popularly comprised in the term "fishes" and is arranged in progressive order. The visitor should first examine the case of hag-fishes and lampreys facing the large window. These rank among the most primitive "fishes." They are without scales, without true teeth, without paired limbs, and their backbone consists of but a rod of cartilage. One of the models shows the way in which a newly caught hag-fish secretes slime, forming around it a great mass of jelly. In the same case are lampreys, and one of them is represented attached to a fish, which it fatally wounds. The nest-building habit of lampreys is illustrated in a neighboring table-case: here the spawners are preparing a pit-like nest

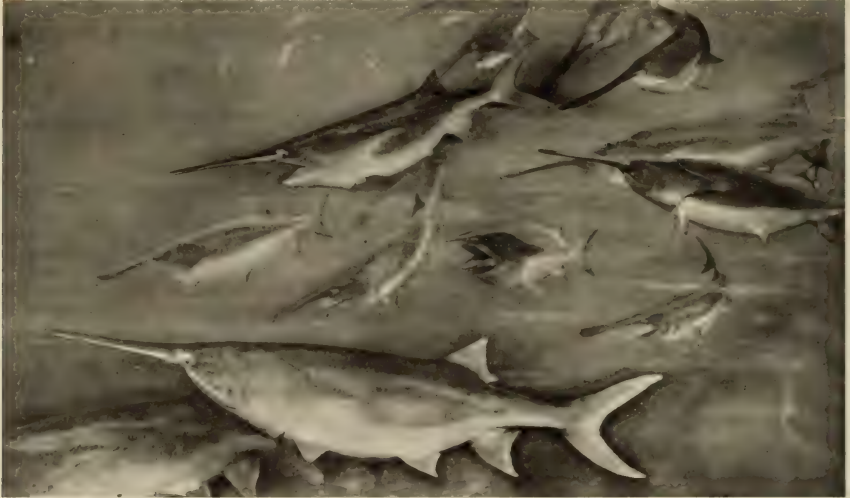
**Hag-fishes
and
Lampreys**

and carrying away stones, which they seize with their sucker-like mouth.

The visitor should next inspect the cases of sharks which are situated near the entrance hall on the south side. These include various forms of sharks and rays, selected as typical members of this ancient group—for the sharks have numerous characters which put them in the ancestral line of all other groups of true fishes.

Next to be visited are the silver sharks or *Chimaeroids*, which are exhibited by the side of the lamprey case. They are now known to be highly modified sharks: their scales have failed to develop, and their heavy "teeth" appear to represent many teeth fused together. These fishes are now very rare and occur, with few exceptions, in the deep sea. The present models show the characteristic forms.

The adjacent case (at the left) pictures the three types of surviving lungfishes, and the models are arranged to indicate the life habits of these interesting forms. Thus, they are shown going to the surface of the water to breathe; and their positions indicate that they use their paired fins just as a salamander uses its arms and legs. In fact there is reason to believe that the land-living vertebrates are descended from some ancient form of lungfish. One sees in this case also a "cocoon," in which the African lungfish passes the months when the streams are dried up; it then breathes only by its lungs.



A PORTION OF THE PADDLE-FISH GROUP

One now passes into the north aisle of the fish gallery and stops at the first case on the left. Here appear all types of existing Ganoids. These are fishes that represent, as it were, a half-way station between lungfishes and sharks on the one hand, and the

great tribe of bony fishes on the other—such as perches, basses, cod, etc. In this case one sees gar pikes, sturgeons, the mud-fish (*Amia*), together with the African *Bichir*, a curious Ganoid encased in bony scales and retaining structures which bring it close to the ancestral sharks. A further glimpse of the Ganoids may now be had by returning near the entrance of the fish hall and viewing the spoonbill sturgeon (*paddle-fish*) group, in which a number of these eccentric fishes are shown side by side with gar pikes and other characteristic forms from the Lower Mississippi. This groups was secured through the Dodge Fund.

Returning then to the north wing of the gallery the remaining cases give characteristic examples of the various groups of modern “bony fishes,” or Teleosts. There are twenty-six cases of them in all, but they offer little space in which to illustrate the 10,500 species. For these are the fishes which are dominant in the present age, contributing over nine-tenths of all existing forms and including nearly all food and game fishes, such as bass, cod, eel and herring. One of the cases of the Teleosts exhibits the grotesque fishes from deep

Deep Sea Fishes water, in which they occur to the surprising depth of over 2,000 fathoms. They are usually soft in substance, with huge heads and dwarfish bodies, and are often provided with illuminating organs like little electric bulbs, which can be “shunted off or on” by the fish, and enable the fishes either to see their neighbors or to attract them.

The cases should be examined in the order numbered (beginning with 14); and one may pass in review the cat-fishes, carps, eels, trout, salmon, pike, mullets, mackerel, basses, wrasses, drumfish, sculpins, cods, flat-fishes and anglers.

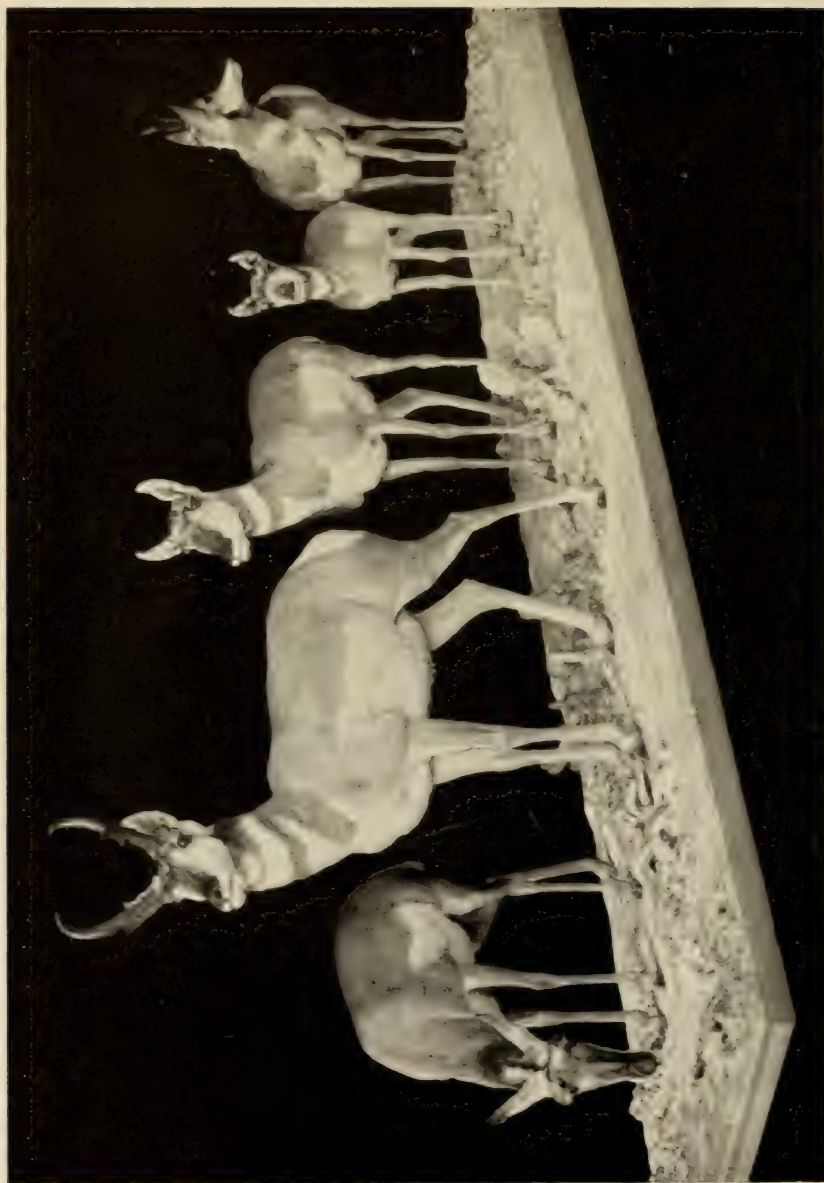
Before the visitor has completed his review of the gallery, he should examine the three wall-cases which explain the characteristic structures of fishes of different groups, and the way in which the groups are related to one another. In one of these wall-cases various kinds of fishes have been arranged in a genealogical tree, and the lines and labels give an idea of their evolution.

Among the conspicuous exhibits of the gallery one notices a sun-fish (*Mola*), which is the largest example of which we have any exact record (it is 9 feet from tip to tip); also a 12 ft. 9 in. thresher shark, and a gar pike, 7 ft. 4 in. long.

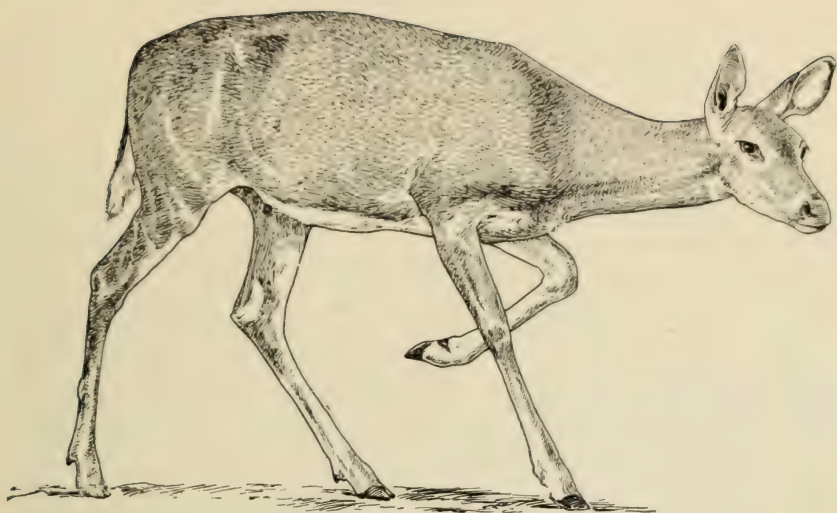
In the window are groups showing the shovel-nosed sturgeon, the spawning habits of the fresh water dogfish, *Amia*, and the slender-nosed garpike.

An exhibit of fossil fishes is to be found on the fourth floor.

[Return to the elevators.]



A GROUP OF PRONGHORN ANTELOPE SHOWING THE MANNER IN WHICH THEY WANDER ACROSS THE PLAINS
This animal is peculiar to North America, and is the only hollow-horned ruminant in which the horn sheaths are shed yearly



THE VIRGINIA DEER—A CHARACTERISTIC NORTH AMERICAN MAMMAL

Line drawing from the mounted specimen. This Virginia doe stands as the first example in the Museum of the new methods of animal sculpture as opposed to the old taxidermy. It was mounted and presented by Carl E. Akeley in 1902.

SOUTHEAST WING

MAMMALS OF NORTH AMERICA

Continuing east beyond the elevator corridor, we enter the hall containing specimens of North American mammals. In the cases on the west wall are groups illustrating the mammals found within fifty miles of New York City. The first of these groups shows the opossum, the sole representative in the United States of the marsupial or pouched mammals. With what appear to be the head and ears of a pig and the prehensile tail of a monkey, with a strange pouch for the transportation of the young, and with proverbial cunning and remarkable tenacity of life, the opossum is one of the quaintest and most interesting of North American mammals. This is the animal so famous in the negro songs of the South.

✓ Opossum

Raccoon

Next in order is the raccoon, more commonly known as the "coon." It is nocturnal in habit and makes its nest in hollow trees. Two species of fox are shown, the red fox and the gray fox, both of which are justly famous for their sly cunning.

The common skunk is a very useful although greatly abused animal. While it occasionally destroys poultry and other birds, its principal food consists of injurious insects and field mice. Its defensive weapon is an excessively fetid fluid secreted by a pair of glands situated near the base of the tail. It has the ability to eject this



THE WEASEL GROUP

One of the groups representing the small mammals found within fifty miles of New York City. The others of the series show opossum, raccoon, red and gray foxes, skunk, mink, muskrat, woodchuck, rabbits and squirrels. The list includes some "fur-bearing" species; weasel fur is often used instead of ermine.

fluid to a considerable distance. Its skin makes a valuable fur known as "Alaskan sable."

Two other fur-bearing animals shown are the mink and the weasel, the latter in both its summer dress of dull brown and its winter coat of white. Weasel fur is often used in place of ermine.

Another fur-bearing animal shown is the muskrat. In the group are seen its summer home, usually a burrow in the bank of a stream or pond, and its winter mound, constructed of swamp grass and roots mixed with mud. Muskrats are extensively trapped for their fur.

The woodchuck or ground hog is a vegetable feeder but does very little harm to crops. It hibernates for a large part of the year usually from September to April. The old legend says that the ground hog comes out of his hole on the second of February and if it is bright and he sees his shadow, he goes back into his hole for six weeks longer and we may expect more cold weather. Other groups represent the varying hare and the common species of squirrels.

In the central section of the hall is a group of moose. It represents an early autumn scene in a second growth forest in New Brunswick, and illustrates one of the favorite feeding grounds of the moose. Beyond the moose exhibit are species of mammals found within fifty miles of New York City, namely Virginia deer, the otter and the wild cat or lynx.



BISON COW AND CALF

The big game of North America is described in *Guide Leaflet No. 5, North American Ruminants*.

The buffalo group gives a typical bit of the prairie traversed by buffalo trails, while the members of the herd represent different stages of growth of the buffalo. This is the animal which formerly roamed in countless numbers over the western plains but which is now reduced to a few insignificant herds.



GROUP OF FUR SEALS

On the south side of the hall are displayed the cloven-hoofed animals of North America. These include sheep, musk ox, caribou, collared peccary and various species of deer. In one of the alcove cases is a group of antelope showing the manner in which they wander across the plains.

**Antelope
Group**

Here too are, for the time being, shown the mammals of the polar regions, placed in the North American hall in order that the *South-east Pavilion*, which once harbored them, may be used as a workroom for the preparation of a group of African Elephants and other mammals from the dark continent. Though the room is closed to the public yet much of the interesting work of preparing these groups may be seen from the gallery above, and later on visitors will be admitted on certain days.

Here is shown a family of fur seals as it appears in one of the seal rookeries in the Pribilof Islands. During the breeding season the fur seals, from which is obtained the sealskin of commerce, congregate in their island rookeries in great numbers.

**Fur Seal
Group**

Grant's caribou inhabit the barren ground of the extreme western end of the Alaskan peninsula. The type specimen of this species is in the Museum.

**Grant's
Caribou Group**

Near by is a group of the Atlantic walrus. These huge mammals are relatives of the seals, inhabit the waters of the far north and are still fairly abundant along the shores of Greenland. The seal and walrus are the animals which play such an important part in the life of the Eskimo. From these animals come the principal food supply, skins for clothing, for fishing and hunting gear, boat covers, and harnesses for dog teams; from bones and tusks are made knives, bows, harpoons, and other hunting and cooking utensils.

Walrus Group

The Roosevelt elk or wapiti inhabits the Coast Range of mountains from British Columbia to northern California. These animals, formerly very abundant, are nearing the verge of extinction through indescribable slaughter.

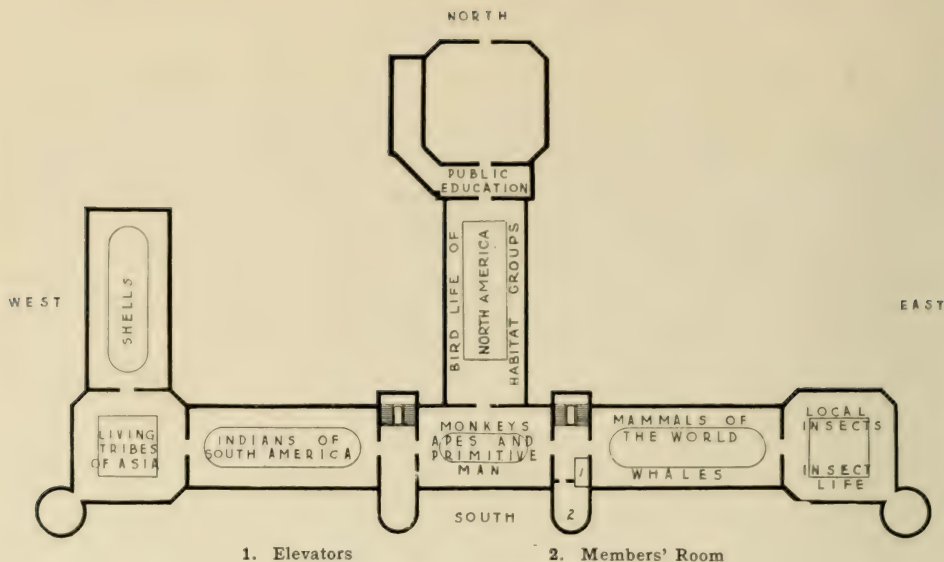
Roosevelt Elk

The specimens in the musk ox group were collected for the Museum by Admiral Peary in 1896. Musk oxen inhabit the snow-covered wastes of the Arctic barrens, living mainly upon willow leaves, dug up from under the snow.

**Peary Musk
Ox Group**

SOUTHEAST PAVILION

Being used as a workroom; see paragraph above.



THIRD FLOOR

EAST CORRIDOR

Members' Room

To the left of the elevators is a room set apart for the use of honorary or subscribing members of the Museum, where they may leave their wraps, rest, write letters or meet their friends.

SOUTH PAVILION

MONKEYS, APES, RODENTS, BATS

This is one of the halls in course of rearrangement and, in the final plan, is intended to include primitive man as well as the other members of the order Primates.

The family of orang-utans, on the south side, was one of the first group of large animals to be mounted in this country, and was considered a daring innovation. Near by are examples of the gorilla, the largest and most powerful of the great apes and the chimpanzee, which is the most like man in proportions and structure. "Mr. Crowley," one of the few full grown apes that have endured captivity, lived for some time in the Central Park Zoo. Skeletons of man and the large apes illustrate the similarities and difference in structures between them.

The bats, the only mammals that really fly, and rodents, the most numerous and widely distributed of mammals are provisionally placed in this hall pending other arrangements.

Suspended from the ceiling in the center of the hall is the skeleton of a medium sized North Atlantic right whale, a species once common on our coast, but now all but exterminated in the North Atlantic.



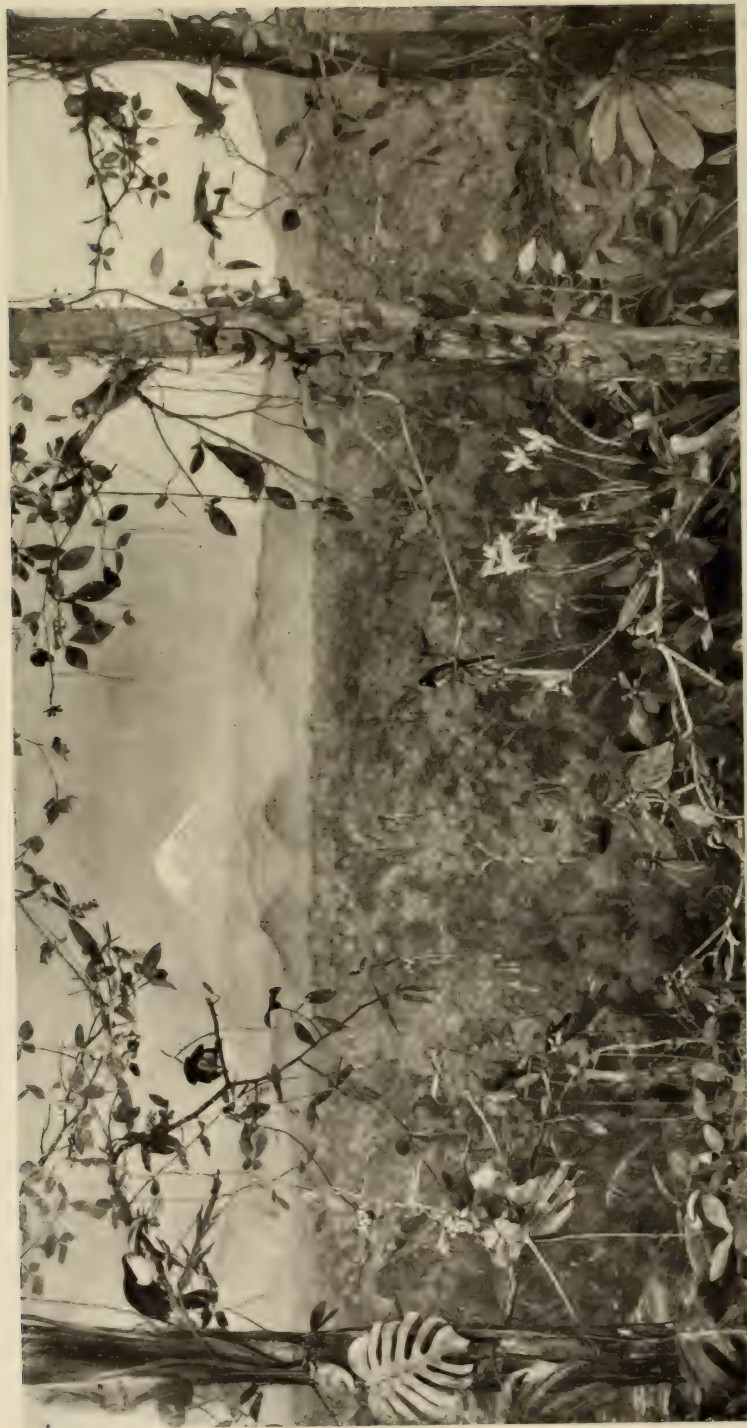
DUCK HAWK ON PALISADES OF THE HUDSON

Realism and artistic effect have been achieved in the "Habitat Bird Groups," and they present vividly many stories of adaptation to environment.

SOUTH CENTRAL WING

BIRD GROUPS

Here are the "Habitat Groups" of North American Birds. This unique series of groups shows the habits of some typical American birds in their natural haunts. The groups have been prepared under the immediate direction of Frank M. Chapman, Curator of Ornithology, who collected most of the specimens and made practically all of the field studies necessary for their reproduction. In the course of this collecting, he traveled more than 60,000 miles. The backgrounds are reproductions of specific localities, painted from sketches made by the artist who usually accompanied the naturalists when the field studies for the groups were made. Practically all sections of the country are represented, thus the series not only depicts characteristic bird life of North America but characteristic American scenery as well. The backgrounds of the groups were painted by Bruce Horsfall, Charles J. Hittell, J. Hobart Nichols, Carl Rungius, W. B. Cox and Louis A. Fuertes. The foliage and flowers



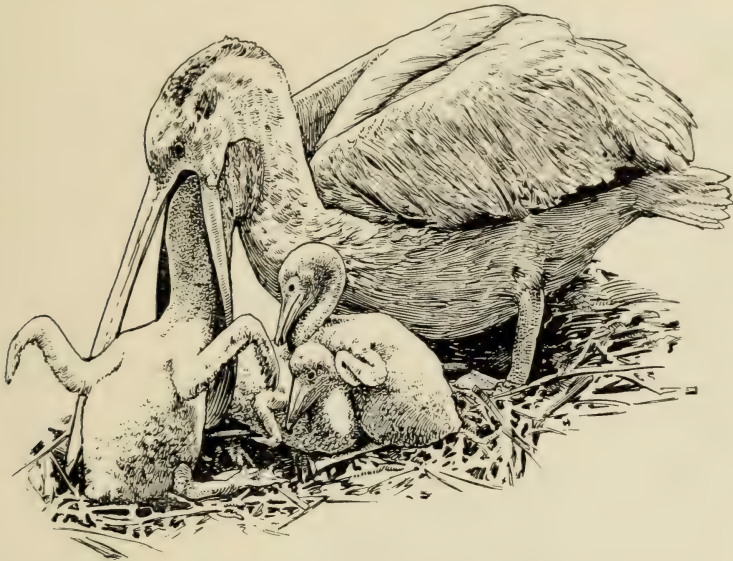
THE ORIZABA GROUP

The observer is looking across the valley of the Río Blanca, over the tropical forest, to Mount Orizaba.

were reproduced in the Museum laboratories from material collected in the localities represented. Each group is fully described in the label attached to the case. [See *Guide Leaflets* No. 28 and No. 22.] Beginning with the case at the right of the entrance and passing on to the right around the hall, we find the groups arranged in the following sequence:

The distribution of birds, notwithstanding their powers of flight, is limited in great measure by climate. Thus in traveling from Panama north to Greenland there are zones of bird life corresponding to the zones of temperature. This condition is illustrated in the mountain of Orizaba in Mexico, where in traveling from the tropical jungle at its base to its snow clad peak the

Orizaba
Group



White pelican from Klamath Lake Group, Oregon. One young bird is illustrating its amusing method of procuring food from its parent's throat.

naturalist finds zones of life comparable with those to be found in traveling north on the continent. Thus the Orizaba group so far as the distribution of life is concerned is an epitome of all the groups in the hall.

Among our most beautiful and graceful shore birds are the terns and gulls, which (because of their plumage) have been so ceaselessly hunted and slaughtered for millinery purposes that now in their breeding places there are only hundreds where formerly there were thousands. The group represents a section of an island off the Virginia coast where the birds are now protected by law.

Cobb's Island
Group

The duck hawk may be found nesting on the Palisades of the Hudson almost within the limits of New York City. It builds

nests on the ledges of the towering cliffs. This hawk is a near relative of the falcon which was so much used for hunting in the Middle Ages.

In August and September the meadows and marshlands in the vicinity of Hackensack, New Jersey, are teeming with bird life. In the group

showing these Hackensack meadows are swallows preparing to migrate southward, bobolinks or rice birds in fall plumage, red-winged blackbirds, rails and the wood duck.

The wild turkey is a native of America and was once abundant in the wooded regions of the eastern portion of the United States, but is now very rare. It differs in color from the Mexican bird, the ancestor of our common barnyard turkey, which was introduced from Mexico into Europe about 1530 and was brought by the colonists

to America. (Reproduced from studies near Slaty Forks, West Virginia.)

The great blue heron usually nests in trees. The bird flies with its neck curved back on its body and because of this habit can readily be distinguished from the crane with which it is frequently confounded. (Reproduced from studies near St. Lucie, Florida.)

In the "bonnets" or yellow pond lily swamps with cypresses and cabbage palmettoes, the shy water turkey builds its nest. It receives the name "turkey" from its turkey-like tail and the title "snake-bird" from its habit of swimming with only the long slender neck above water. (Reproduced from studies near St. Lucie, Florida.)

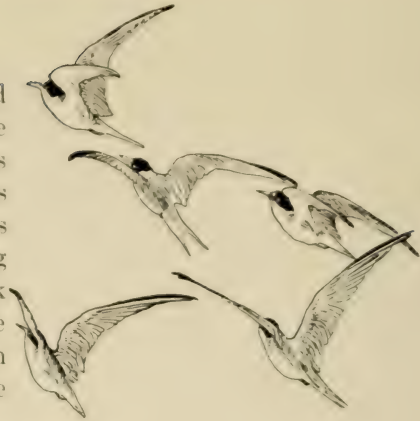
Duck Hawk Group

Hackensack Meadow Group

Wild Turkey Group

Florida Great Blue Heron Group

Water Turkey or "Snake-bird" Group



Terns

Cobb's Island Group

The sandhill crane builds its nest of reeds in the water. Unlike the herons in this respect, it differs also in its manner of flight, always stretching its neck well out when on the wing. (Reproduced from studies on the Kissimmee Prairies of Florida.)

**Sandhill Crane
Group**

Pelican Island on the Indian River of Florida has been made a reservation by the United States Government and these grotesque birds may now breed there undisturbed. The view shows a section of the island at the height of the nesting season. Notwithstanding the hundreds of young birds that are clamoring for food, observation has shown that the parent bird can pick out its own offspring with unfailing accuracy. (Reproduced from studies at Pelican Island, Florida.)

**Brown Pelican
Group**

This beautiful bird has been brought to the verge of extinction in this country through the use of its "aigrette plumes" for millinery purposes, and is now confined to a few protected rookeries of the South. The birds have these plumes only during the nesting season, at which time the death of the parent means the starvation of the young. (Reproduced from studies in a rookery of South Carolina.)

**Snowy Heron
or Egret
Group**



A PORTION OF THE EGRET GROUP

As shown here the birds carry their plumes only during the nesting season; killing the parents means the slow starvation of the young.

The turkey vulture or buzzard is one of the best known birds of the South where it performs a valuable service in acting as the scavenger of the streets. On this account it is protected by law and by public sentiment and has become both abun-

**Turkey Vulture
Group**



A FLAMINGO COLONY IN THE BAHAMAS

A "city" of these birds is the most remarkable sight in the world of birds. The mud nests are raised from eight to fourteen inches, and thus protected during rise of water.

dant and tame. (Reproduced from studies at Plummer Island in the Potomac River, near Washington.)

The California condor is the largest and one of the rarest of North American birds. It is not so heavy as the condor of the Andes but has a slightly greater spread of wing, eight and one-half to eleven feet. In the group the visitor is supposed to be standing in the interior of the cave where the bird has its nest and is looking down on the river of the cañon which is more than five thousand feet below. (Reproduced from studies in Piru Cañon, California.)

The foreground of the group shows a detail of the island that is painted in the background. The young birds are feeding and it will be noticed that one fledgeling is reaching well down the mother's throat after the predigested food. (Reproduced from studies at Monterey, California.)

Formerly this area was an arid place with a characteristic desert bird fauna. Now the ranchmen have irrigated the land and aquatic bird life abounds. This group is a good illustration of the influence of man on the bird life of a region.

In the breeding season the flamingos congregate in great numbers in their rookeries. There were estimated to be two thousand nests in this colony. The flamingos construct their nests by scooping up mud with their bills and packing it down by means of bills and feet. The nests are raised to a height of twelve or fourteen inches; this protects eggs and young from disasters due to high water. Only one egg is laid in the nest, and the young is born covered with down like a young duck and is fed by the mother on predigested food. The brilliant plumage of the adult is not acquired until the fifth or sixth moult. (Reproduced from studies in the Bahama Islands.)

In this group is shown a portion of a coral islet on which three thousand boobies and four hundred man-of-war birds were nesting, the former on the ground, the latter in the sea grape bushes. (Reproduced from studies in the Bahama Islands.)

The abundance of bird life in one of these rookeries is quite astounding. In this group are roseate spoonbills, snowy egrets, American egrets, little blue herons, Louisiana herons, ibises, cormorants and water turkeys. Because of the great inaccessibility of this island it has been one of the last places to escape the depredations of the plume-hunter. (Reproduced from studies in the Everglades of Florida.)

The golden eagle is one of the most widely distributed of birds.

In North America it is now most common in the region from the Rockies to the Pacific coast, although it is found as far east as Maine. Stories to the contrary notwithstanding, the eagle never attacks man even though the nest is approached.

Its food consists of rabbits, squirrels, woodchucks and occasionally sheep. (Reproduced from studies near Bates Hole, Wyoming.)

The abundance of bird life in this western lake beneath Mt. Shasta, which is seen in the center of the background, is astonishing. Here is an

example of how the normal nesting habits of a bird may be changed by its being driven into a different locality. In the group are white pelicans which usually make a nest of pebbles, Caspian terns which commonly build their nests on sand, and cormorants that nest on rocks, all nesting together here on the tule or rush islets of the lake. (Reproduced from studies at Klamath Lake, Oregon.)

The scene represented in this group is above timber line on the crest of the Canadian Rockies—8,000 feet above the sea. Although these mountains are in the temperate region the altitude gives climatic conditions that would be found in the far north, and the bird life is arctic in character. Here are nesting the white-tailed ptarmigan, rosy snow finches and pipits. (Reproduced from studies in the Canadian Rockies.)

This group shows a stretch of western plateau covered with sage bush. In this bush is seen the male sage grouse strutting and wooing a mate. (Reproduced from studies at Medicine Bow, Wyoming.)

The prairie chickens are akin to the common grouse. The group represents a typical scene during the mating season. The male birds go through most surprising antics in their efforts to attract the females. They inflate the orange-colored sacs on the sides of their necks, dancing and strutting about and uttering a loud, resonant, booming note. (Reproduced from studies near Halsey, Nebraska.)

The wild goose is one of the first birds to migrate north in the spring. It nests in the lakes of Canada even before the ice is melted. To secure the young birds for this group it was necessary to hatch the eggs of the wild goose under a hen, so difficult is it to find the young in nature. (Reproduced from studies made at Crane Lake, Saskatchewan, Canada.)

The grebe is another of our aquatic birds which builds its nest near the water. During the incubation period the parent bird usually covers the eggs with grass and reeds when leaving the nest. Nesting at the same

lake with the grebe was the red-head duck, which lays from fifteen to twenty eggs. (Reproduced from studies made at Crane Lake, Saskatchewan, Canada.)

The loon is justly famed for its skill as a diver, and can swim with great speed under water. Its weird call is a familiar sound on the northern New England lakes. Many loons pass the winter at sea fifty miles or more from land. (Reproduced from studies at Lake Umbagog, New Hampshire.)

Bird Rock Group

This rocky island thirty miles from shore in the Gulf of St. Lawrence affords some protection to the sea birds which still nest in great numbers on and in its cliffs, although the colony is a mere shadow of what it was even fifty years ago. Seven species are shown nesting in the group. Namely the razor-billed auk, petrel, gannet, puffin, Kittiwake gull, common murre and Brunnich's murre. (Reproduced from studies at Bird Rock, Gulf of St. Lawrence.) This was the first habitat group.

[Return to the South Pavilion containing the apes and monkeys.]

WEST CORRIDOR ✓

PUBLIC HEALTH

Returning to the South Pavilion where the monkeys are, and passing to the right, we enter the *West Corridor* containing the exhibits of the Department of Public Health.

The first section of the exhibit deals with the natural history of water supply as it affects the life and health of man. Large photographs at the entrance to the corridor on the left illustrate the primary source of water supply, the clouds, and the secondary sources, the rivers and lakes. Diagrams, models and a relief map show the variations in rainfall at different points in the United States. Relief maps of the region about Clinton, Massachusetts, before and after the construction of the Wachusett Reservoir for the water-supply of Boston, show the way in which surface water supplies are collected by impounding streams, and a model of a well sunk through



Love making of the prairie chicken. In this position and with orange-like air sacks inflated, he produces a booming sound which may carry a distance of two miles.



Gathering Driftwood from the polluted waters about the Battery.
One of the ways by which typhoid fever is spread.
One of a series of models illustrating the danger from impure water.

impervious to water-bearing strata shows how ground-water supplies are obtained. A series of samples and models illustrate the variations in composition which occur in natural waters, from the swamps of Virginia to the deep wells of Iowa and the turbid rivers of the Ohio valley.

Some of the principal micro-organisms, Algæ and Protozoa, which grow in reservoirs and impart tastes and odors to water are represented by a series of glass models. The effect produced by the pollution of water by disease germs is illustrated by relief maps and diagrams showing the course of famous typhoid and cholera epidemics. Models are displayed which illustrate the purification of water by storage, filtration and disinfection, the filter model being an elaborate representation of the plant at Little Falls, N. J. Diagrams and models indicate the results of water purification as measured both in dollars and cents and in the saving of human life. Finally a series of five large relief maps shows the growth and development of the water supply of New York City.

Following the water-supply exhibit is a series of models illustrating the dangers from improper disposal of the liquid wastes of the city and how they may be avoided. Actual points of danger in the neighborhood of New York are shown where polluted harbor waters, bathing places and shell-fish beds are a

**Disposal of
City Wastes**

menace to health. The modern methods for the treatment of sewage on scientific lines are illustrated by a series of models of screens, sedimentation tanks and filter beds of various types.

The cases near the window are devoted to the group of Bacteria, especially in their relation to human life. Glass models show the various shapes and relative sizes of these minute forms and in particular of the principal types which cause disease. In a nearby case are displayed actual colonies of a number of species of bacteria including some which produce disease and others which are beneficial to man by their effect upon soil fertility or the fact that they may be utilized in the production of substances useful as foods or in the arts. A group of transparencies at the window shows some of the more important disease bacteria as they appear under the microscope.

Another series of exhibits deals with the transmission of disease by insects, notably by the fly and flea. The most striking feature of these is a model of the fly, a little over a foot in length, and having the bulk of 64,000 flies. This, the finest model of the kind ever made, was prepared by Ignaz Matusch from his original studies, and required nearly a year of constant, exacting labor.

The deadly work of the fly in carrying typhoid fever is illustrated by a representation of two companies of soldiers, showing the comparative mortality from flies and bullets during the Spanish-American war. One company confronted by a cannon, suffers the loss of one man wounded; another facing a tube of typhoid germs—distributed by flies—has one dead and thirteen in the hospital.

Nearby are two models showing unsanitary and sanitary conditions on a small farm. In one, pools of stagnant water and uncovered manure heaps and general uncleanness favor the breeding of mosquitoes and flies, while the open doors and windows give these insects free access to the house. In the other, the swampy land is drained and cultivated, the windows screened, the shallow dug well replaced by a driven well; the conditions are sanitary and health and prosperity replace sickness and poverty.

The manner in which bubonic plague is disseminated is shown by a copy of a corner of a house in San Francisco infested by rats, which carry the fleas, that hold the germs that introduced into the blood by the bite of an insect give rise to bubonic plague, the black death of the Middle Ages.

In a window case are shown various stages of the common mosquito, *Culex*, as well as of *Anopheles*, the carrier of Malaria and malaria, and *Stegomyia*, which is responsible for the Yellow Fever spread of yellow fever.

[See *Guide Leaflet* No. 33.]

The collection of Auduboniana, or objects relating to the life and works of John J. Audubon, presented to the Museum by Auduboniana his granddaughters, Maria R. and Florence Audubon, occupies the stairway hall. It includes original sketches and paintings by Audubon and his sons, illustrations in various stages from the Quadrupeds of North America, and some of the copper plates of the Birds of North America. Of more personal interest is the gun carried by Audubon on many of his expeditions and a favorite buckskin hunting coat.

SOUTHWEST WING

INDIANS OF SOUTH AMERICA

Passing through the west corridor, where the exhibit of the Department of Public Health is installed, and on into the adjoining hall to the west, we find the collections relating to the Indians of South America.

Indians of
South
America

The greater part of the hall is filled with archæological material from Peru, Bolivia, Ecuador and Chile, illustrating the various forms of culture that prevailed in the territory generally known as the land of the Incas. These

Indians, together with the Mexican Indians, attained the highest type



PIECES OF CLOTH FOUND WITH PERUVIAN MUMMIES

The only sources of knowledge of prehistoric Peruvians come from their graves. They were familiar with most modern weaves including the finest gobelins and produced highly decorative effects by harmonized colors and a repetition of woven-in designs. The Museum's collection of mummy cloths is one of the largest in the world, and is much used by teachers and students of art.

of civilization on this continent in prehistoric times. Unlike the Mexicans however, they had no written language. They were tillers of the soil and raised maize, potatoes, oca, quinoa, beans, coca and cotton. The Incas domesticated the llama, which was used as a beast of burden. They excelled in the manufacture and decoration of pottery vessels, in metalwork, and in textile fabrics. In the case directly in front of the

Gold and
Silver

entrance are displayed gold and silver objects such as beads, cups, pins and earrings which show the high degree of skill attained in the beating, soldering and casting of

Textiles

metals. In weaving they were perhaps preeminent among prehistoric peoples, many of their specimens exhibited here being unsurpassed at the present day. The materials used were cotton and the wool of the llama, alpaca and vicuña. In the first cases on the right are examples of these textiles with looms and shuttles. [The musical instruments of ancient Peru are discussed in *Guide Leaflet No. 11.*]



PERUVIAN MUMMY BUNDLES AND MUMMY

The ancient Peruvians wrapped their dead in fabrics of fine cotton and wool, then covering with a sack of strong cloth. The mummy "bundle" thus produced was often given a "false head" of cloth filled with vegetable fibre. Climatic conditions in Peru have preserved these mummies and their wrappings during many centuries



TREPHINED SKULLS FROM PREHISTORIC PERUVIAN GRAVES, INDICATING THE PRACTICE OF SURGICAL OR SACRIFICIAL OPERATIONS

The alcove cases are geographically arranged, showing exhibits from the north toward the south of South America, then up into the interior of the continent. Bronze and copper work, slings such as are still in use, portrait jars, vessels upon which the decorations represent animals, fruit and vegetables and scenes from daily life, are all prehistoric and many of the specimens are of rare beauty as well as valuable from an archæological standpoint.

The special exhibits in the gallery rail cases include quipus used to keep accounts, charms and medicines, coca which was chewed with lime, and shells that were found in mummy-bundles and in the graves. A number of the chicha jars are on exhibition on top of the cases.

In the first case to the left (south side) is a collection of skulls showing many examples of trephining, artificial deformation and pathological conditions, together with a number of normal Peruvian skulls for comparison.

The wall case at the left of the entrance contains mummy bundles and various objects showing the burial customs of the Peruvians. In no part of America are found so many and so extensive burial places as in the coast region of Peru. Here were interred countless thousands of the ancient dead. In the *huacos* or graves, with the bodies, were placed such articles as had been most useful and highly prized during life, and such as it was considered would be most serviceable in a future life.

To this custom we are indebted for no small part of our knowledge of the daily life of the ancient Peruvians. From the mummy bundles and graves all the objects in the extensive collections in this hall, illustrating their civilization have been obtained. The wonderful state of preservation shown in the textile fabrics and other perishable materials from the coast regions is due to the extreme dryness of the climate and the nitrous character of the soil. [See *Guide Leaflet* No. 24.]

The mummy in the case at the west end of the room was found at Chuquicamata, Chile, and is the body of an Indian which has been remarkably preserved by nature. This Indian probably met his death by the caving in of some mine, and in the dry climate of the region the tissues of the body have been so thoroughly impregnated with copper salts that the original form of the man is retained. By his side are the rude stone tools used in mining copper ore, and other objects found with him.

On the north side of the wall are the ethnological collections from Brazil, British Guiana, Paraguay and Colombia. War implements, basketry, featherwork and musical instruments are arranged in these cases.

SOUTHWEST PAVILION

CHINESE AND SIBERIAN COLLECTIONS

Collections
 From Asia

If we pass on into the hall at the extreme west end of the building, we find collections from eastern and northern Asia. The arrangement is geographical. Read carefully the label at the entrance to the hall. Specimens illustrating the culture, industries, religion and manufactures of China are on the left; others showing the mode of living, the costumes and the war implements of

Siberia are on the right. Bamboo, porcelain, basketry, inlaid work, cloisonne enamel, agricultural implements, carvings in wood, ivory and stone, and embroidery are shown to advantage. The furwork, costumes and rugs of the people of East Siberia reveal remarkable skill in workmanship. Two models show respectively summer and winter scenes in Siberia. A small model in one of the cases to the left shows the manner of making pottery. A series of frames in the rear contain pieces of various kinds of fabrics and patterns illustrating weaving and woodwork ornaments.

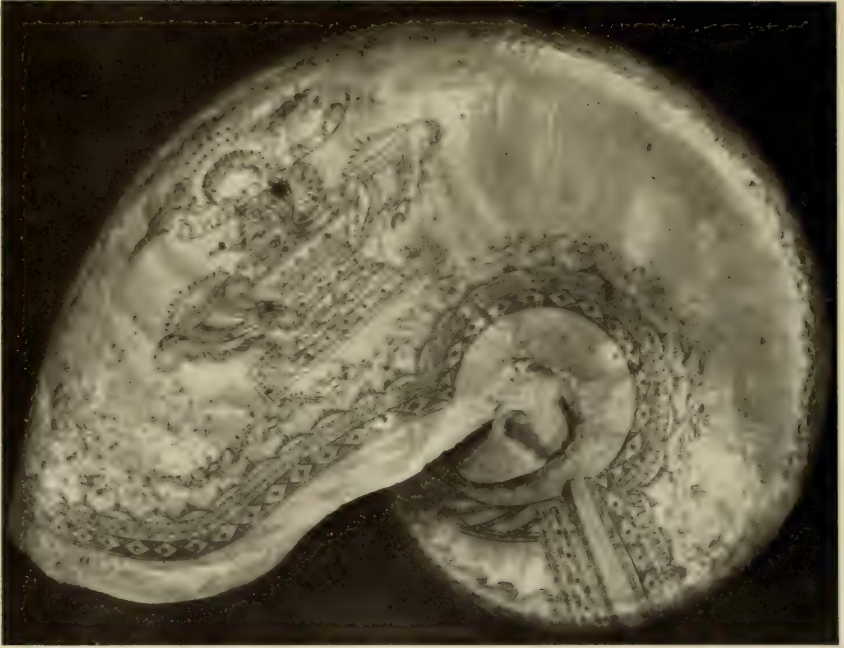
The collections deal mainly with the everyday life of the Modern Chinese and have a special value as they were made just before the sweeping changes of the last few years took place. These abolished many of the

customs in which these objects were used; for example, the series of weapons and objects showing the tests to which a soldier was submitted on entering the army have been rendered obsolete by the introduction of modern weapons and tactics.

A special collection of great value is found in the ancient bronzes shown in the adjoining tower room.



ANCIENT CHINESE BRONZE



PEARLY NAUTILUS, POLISHED AND ENGRAVED

The polished shell of the Pearly Nautilus has been employed frequently as a surface for engraving and the inscription of legends, prayers and emblems.

WEST WING

SHELLS

The collection of shells is being installed in the *West Wing* and is not yet fully open to exhibition. It contains altogether about 100,000 specimens representative of nearly 15,000 species. These show extraordinary range of color and ornamentation. The arrangement of the collection is still incomplete but the installation will be as follows: first, in the south wall cases will be placed a series showing briefly the classification of mollusks; second, in the eight table cases at the north and south ends of the hall the collections of land shells; third, in the upright railing cases the bivalves or mollusks which have two shells like the common clam; fourth, in the metallic cases the univalves, mollusks which have only one valve or shell like the snails; fifth, special exhibits of shells in the north wall cases. Other cases will contain exhibits illustrating the anatomy and habits of mollusks: colored transparencies will show them in their habitats.

[Return to the South Pavilion containing the apes and monkeys.]

SOUTHEAST WING ✓

MAMMALS OF THE WORLD

Continuing east from the hall where are the apes and monkeys, we pass the elevators, to enter the hall of the *Southeast Wing*, devoted mainly to the Principal Families of Mammals and their Evolution in Past Ages. The exhibits read like the pages of a book from left to right,

**Mammals of
the World**

being arranged to bring out the phylogeny or past history and development of the chief divisions of mammals. The specimens are arranged not on shelves but close against

the background of the case on small projecting supports and from each a cord has been stretched down along the background to a diagrammatic representation of the geological periods. In this way are indicated the relationships of the various animals to one another as well as the geological age in which each animal probably originated. Circling the hall above the cases is a mural frieze representing marine scenes, which serves as a background for groups of porpoises, dolphins and other small members of the whale family. The most striking object in the hall is the life-size model of a sulphur-bottom whale, seventy-nine feet in length. The

**Model of
Sulphur-
bottom
Whale**

original of this specimen was captured in Newfoundland and the model is accurately reproduced from careful measurements. This huge creature is not only the largest of living animals, but, so far as we know, the largest animal that has ever lived: A specimen of this size

weighs from sixty to seventy tons, about twice as much as *Brontosaurus*. As can be seen by examining the models of a whale's head attached to the pillar, the whalebone which takes the place of teeth hangs in great plates from the inside of the upper jaw. This whalebone acts as a strainer in the mouth of the whale and extracts the small animals from the sea water which the whale takes into his mouth when feeding. The food consists mostly of tiny crustaceans less than an inch in length. Although whales and porpoises live in the water they are not fishes, but are warm-blooded and breathe by means of lungs, not gills. The whale must come to the surface to breathe and the so-called "spouting" is merely the result of the warm air being expelled from the lungs when he breathes. A whale does not spout *water* as is commonly supposed. Models to scale of the other whalebone whales, and the toothed sperm whale, and skeletons of the smaller whales are hung near for comparison.

The plans for the next addition to the Museum building include a large hall to contain whales and other marine animals.

The case along the gallery rail contains insects of many kinds which are placed here temporarily.



GROUP OF MIGRATORY BUTTERFLIES

SOUTHEAST PAVILION

HALL OF INSECT LIFE

Proceeding east, we enter the *Insect Hall*. The installations in this hall point out the relationships, through origin and mode of life, of insects to each other and to the other members of the Animal Kingdom, especially to man. The exhibits are arranged in a continuous series and are numbered so that we can easily follow the plan beginning at the pillar farthest to the left.

Insect Life

First is an introductory section illustrating by diagrams the importance of insects as shown (a) by the large number of species compared with other animals [there are more species of insects than of all other animals put together] and (b) by their great influence on human interests. In the United States, the economic loss by insects is more than five times as great as by fire and there are more than twelve times as many deaths from insect-borne diseases as from railroad accidents. On the other hand, many of our crops and all beautiful flowers are largely dependent upon pollination by insects.

**Importance of
Insects**

Next in order is given an outline of the development of insects as a race, their geological history, anatomy, physiology and embryology. Then begins a graphic discussion of the principles underlying evolution as illustrated by insects.

**Evolution as
Illustrated
by Insects**

Turning to the table cases at the northeast corner of the room, we find photographs of prominent American entomologists; also short biographies and bibliographies which form an introduction to the more detailed study of insects. One case is devoted to collecting apparatus and one to the classification of insects and their allies with typical specimens to illustrate each group. Another case treats of insect architecture. Others show how insects pass the winter, how they lay their eggs, catch their prey, etc. Collections of insects from particular environments and at special seasons hint at the interesting studies to be made along these lines.

Insect Habits

Then come a series of exhibits concerned with the enemies of insects ending with man and showing how insect pests are combated. Another side of the question is then taken up; the carrying of disease by insects. Household insects, aquatic insects and insects which live underground in plants and on their leaves (including some fine models of plant galls produced by insects) are also shown. Beneficial insects such as the silk worm and honey bee are treated in some detail, and in connection with the latter are taken up social

**Insects and
Men**

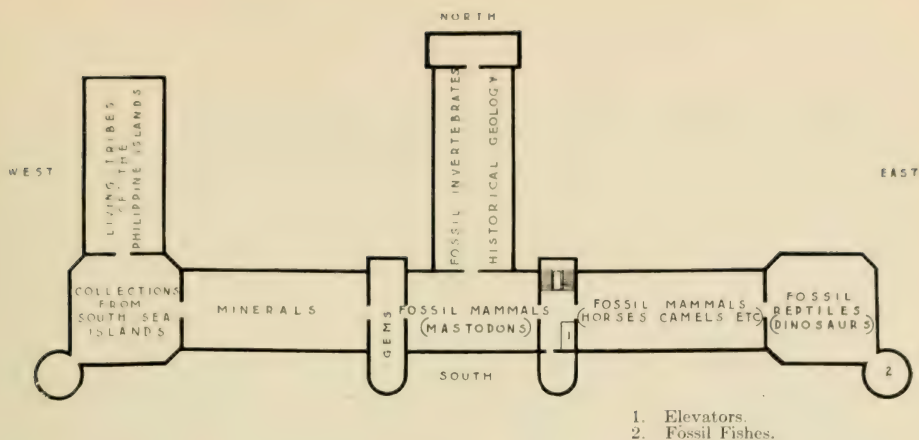
insects in general. There are groups showing a swarm of migratory butterflies, the seventeen year cicada, and a "nest" of one of our largest ants.

Visitors desirous of studying specimens of local insects more in detail are cordially invited to do so by consulting the nearly complete collection to be found in this hall under the custody of the New York Entomological Society.

[Return to the elevators and ascend to the Fourth Floor.]



PART OF THE CICADA GROUP



FOURTH FLOOR ✓

FOREWORD ON FOSSIL VERTEBRATES

In the *East Corridor*, and the *South Pavilion* at the left, as well as in the *East Wing* and *Southeast Pavilion* at the right are displayed the fossil mammals, reptiles and fishes.

In a general way, fossils are the petrified remains of plants or animals that lived at some past period of the earth's history. In many instances we have not the objects themselves but only their casts or impressions in the rocks. This is particularly the case with shells. Sometimes, as with the bones of the great Irish elk the objects have been buried in swamps or bogs, and in a few rare instances as with the mammoth and woolly rhinoceros, entire animals have been preserved for thousands of years in ice or frozen mud. Fossils are found in localities where the dead animals or plants have gradually been buried under layers of sediment to such a depth that they come in contact with the mineral waters of the earth and finally become petrified. Later through subsequent upheaval and erosion they are again brought to or near the surface of the earth. Petrification is the slow replacement of animal or vegetable material by such minerals as carbonate of lime or silica. The process is very slow and for this reason flesh is never petrified. Fossil beds are found in every continent. In our own country, Texas, Montana, Wyoming, and the Bad Lands of South Dakota are famous for their large fossil beds, and many of the finest and rarest fossils in the Museum were obtained in these localities.

As it takes thousands of years for the various layers of earth to accumulate over the bones, and for the latter to become petrified, the study of fossils and the strata in which they are found is an important aid in determining the age of the earth and the succession of life thereon. Many of the skeletons exhibited in these halls are of animals which lived from 30,000 to 20,000,000 years ago. To prepare a specimen for



THE GROUP OF GIANT GROUND SLOTHS

Fossil mammals from South America adapted for digging above the roots of trees for the purpose of pulling them down to feed on the leaves and twigs

(See THE GROUND SLOTH GROUP for a full description.)

exhibition the matrix in which the bones are imbedded is carefully chipped away and the missing parts restored in cement and plaster. The bones are then assembled as in life. In the specimens on exhibition the restored parts differ in color from the original parts of the skeleton and can readily be distinguished.

As a whole, the Museum collections of fossil vertebrates are believed to be the finest in the world, if we take into consideration not merely numbers, but also variety, quality and perfected methods of preparation and exhibition. The collections illustrating the evolution of the horse are probably equal to those of all other institutions combined. The collections of Permian reptiles, of Jurassic and Cretaceous dinosaurs, of turtles, of North American Tertiary mammals, and of extinct mammals of South America, are likewise of the first rank. There are more than seventy complete skeletons on exhibition, several hundred skulls and nearly two thousand jaws or other parts of various species. About ten times this number are in storage, reserved for study and research, or not yet prepared for exhibition.

WEST CORRIDOR

FOSSIL FISHLIKE LIZARDS

Directly in front of the elevator is a wall case in which the most recently acquired specimens are placed. The cases attached to the wall near the stairway contain specimens of huge marine fishlike lizards, which show the tremendous pressure to which fossils are often subjected and the fragmentary condition in which they are found.

SOUTH PAVILION

MASTODONS AND MAMMOTHS

The visitor should first enter the *South Pavilion* in which are shown the skeletons of mammoths and mastodons, the prehistoric relatives of the modern elephants, and of the curious and extraordinary extinct animals which inhabited South America in prehistoric times, 30,000 to 100,000 years ago. On the left is a series of modern skeletons illustrating the evolution of the horse under the hand of man. Here are such extremes as the Shetland pony, only two feet ten inches high, and the rough-boned draught horse, which stands six feet one inch in height. Contrast these with the slender-limbed "Sysonby" the famous race horse, and the Arabian stallion "Nimr." Man by his intelligence has modified the form of the horse to meet his needs and has accomplished in a small degree but rapidly, what nature has done in an extensive way during long ages—as will be seen from the fossil horses in the next hall. The similarity in structure

Skeletons
of Modern
Horses

of the skeletons of horse and man is brought out in the exhibit of a rearing horse being controlled by man. A comparison of these two skeletons will show that with some modification the bones of the one correspond with the bones of the other. The horse lover will also be interested in the osteological collections in the wall cases which show how to tell the age of horses through the growth and development of the teeth.

Beyond the Horse exhibit on the left are fossils from South America, the most striking of which is the group of giant ground sloths. There are also good examples of the Glyptodon, a gigantic relative of the armadillo, of the camel-like *Macrauchenia*, the rhinoceros-like *Toxodon*, and other strange extinct animals which evolved in South America during the Age of Mammals, when it was an island continent, as Australia is to-day. Here too, is the great sabre-tooth tiger, one of the host of northern animals that invaded the southern continent upon its union with the northern world, and swept before them to extinction most of its ancient inhabitants.

The principal exhibits on the north side of the hall are the mammoths and mastodons and the series of skulls showing the evolution of the elephants. The "Warren Mastodon" is a classic specimen. It was found near Newburg, N. Y. in 1846, and is the finest specimen of its kind that has ever been discovered. There is some confusion in the mind of the layman between the mammoth and mastodon; in a general way they are both elephants, the main distinction between them being in the character of the teeth. While modern elephants are confined to portions of Asia and Africa, fossil remains of elephants and mastodons show that at one time or another in the past, they were found over the greater part of the northern hemisphere.

Skeletons of the Asiatic and African elephants are shown for comparison with their extinct relatives and among these, is the once famous Jumbo, whose name has been embodied in the English language as a term for anything unusually large.

[See *Handbook No. 4, Animals of the Past.*]

SOUTHEAST WING

FOSSIL MAMMALS OF THE TERTIARY PERIOD

Return to the East Corridor and continue into the *Southeast Wing* or Tertiary Hall which contains the Fossil Mammals of the Tertiary Period.

The geological age to which all the fossils shown in this hall belong, covers a period of from 100,000 to 3,000,000 years. At each side of the

entrance are charts indicating the successive periods of time from the Triassic to the Tertiary, and the animal life which pertained to each. Careful guides and exhaustive cards of explanation, photographs, and window transparencies combine to make the entire exhibit illuminative and interesting.

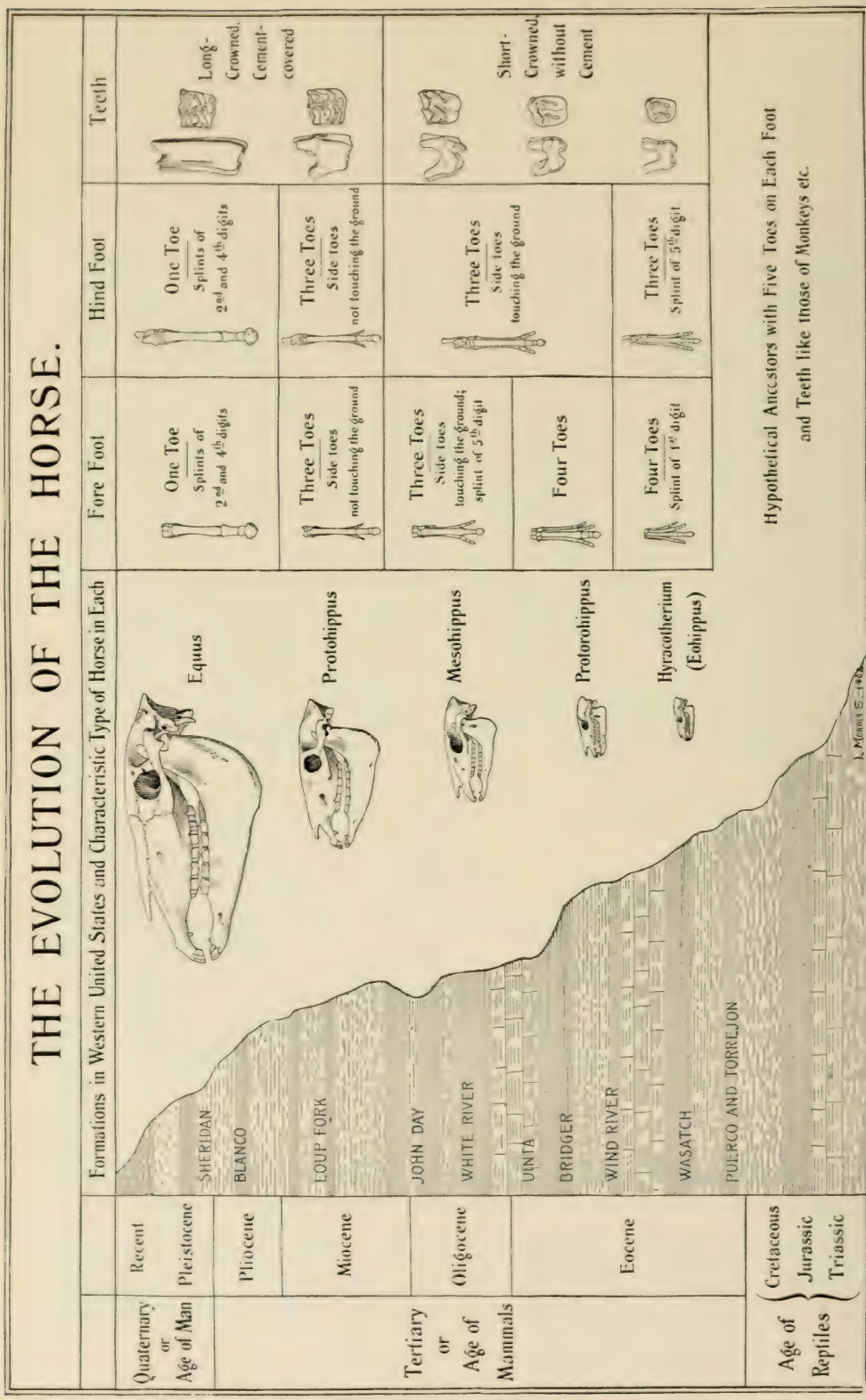


Restoration of *Eohippus*, the four-toed horse. This ancestor of the modern horse, scarcely larger than the red fox, lived some three millions of years ago. It comes from the Lower Eocene of Wyoming and New Mexico.

The particular feature of this hall is the wonderful series in the cases by the entrance and in the first alcoves on the right showing the evolution of the horse in nature. The Museum is justly proud of this collection. Not only is it the largest and finest series of fossil horse skeletons in the world, but it is larger than the combined collections of all other institutions, and it contains the earliest known ancestors of the horse, the little four-toed *Eohippus*, which was no bigger than a fox and on four toes scampered over Tertiary rocks. As will be seen by an examination of the skeletons of the horse and man in the Quaternary Hall, the modern horse walks on the tip of his middle finger and toe. The front hoof bone corresponds to the last joint of the third finger in the human hand, and the other bones of the leg correspond bone for bone with the structure of the finger, wrist and arm of man. In the modern horse the remaining fingers or toes of the fore and hind foot have entirely disappeared, or remain only as vestiges, the so-called "splint bones." The structure of the modern horse

Evolution
of the
Horse

THE EVOLUTION OF THE HORSE.



The history of the evolution of the horse through the Age of Mammals gives the best example in existence of the doctrine of evolution by means of natural selection and the adaptation of a race of animals to its environment. During three millions of years, these animals passed through important changes, especially in the teeth and feet, adapting them more and more perfectly to their particular environment, namely open plains with scanty stunted herbage.



shows that it developed from a five-toed ancestor. This ancestry has been traced back to the four-toed stage. [See *Guide Leaflet No. 36. The Evolution of the Horse.*]

In the wall case at the right of the entrance is given a synopsis of the evolution of the foot and skull of the horse and the geological age in which each stage is found. Across the alcove the visitor will find the skeleton of *Eohippus*, the four-toed stage of the horse and the earliest form that has been discovered. This specimen is from the Wind River beds of Wyoming and may have lived 3,000,000 years ago. It is interesting to note that while there were no horses found in this country by the white settlers, America is the original home of the horse.

Passing from skeleton to skeleton the changes that have taken place in the development of the horse are easily distinguished. The exhibit is made more lifelike by plaster restorations of the animals and by water-color sketches showing primitive horses in their environment. These paintings and models are by Charles R. Knight. In the later types of the three-toed stage the two lateral toes have lost their original function of support and are gradually becoming vestiges. The three-toed horse in the center of the alcove is one of the most complete and finest examples that has ever been unearthed.

Opposite the horse exhibit on the other side of the hall, are series of specimens illustrating the evolution of the camel, deer and other cloven-hoofed animals. These animals like the cow of to-day walked on the tips of the third and fourth fingers, and the gradual disappearance or reduction to useless vestiges of the other fingers and toes can be traced as in the horse series.

The large blocks showing groups of skeletons of early camels, skulls and bones of primitive ruminants in their natural position in the rock, show how these specimens are sometimes found and raise questions as to how they got there, more easily asked than answered. The giant pigs, or elotheres, and the pygmy hippopotamus will repay examination.

The primitive rhinoceros-like animals are shown near the center of the hall on the right. It seems hard to believe that our vast western country and indeed all North America, was

once the home of the rhinoceros. As here indicated great herds roamed over the fields in the Tertiary Period and their fossil remains are found imbedded in the sandstones and clays of the badland formations. Opposite these are shown the ancestors of the dogs, cats and other carnivores and the Creodonts or Primitive Carnivores of the early Tertiary. Next to these are the small mammals—the insectivores, rodents and marsupials; and the fossil lemurs and monkeys, fragmentary but interesting because of their bearing on the ancestry of man.

On the south side on the right are skeletons of titanotheres, on the left of uintatheres, huge extinct, horned animals peculiar to North America.



Restoration of *Brontosaurus*. One of the largest of the amphibious dinosaurs, cold-blooded, slow-moving, unintelligent creatures that grew to large size (65 ft. in length) in the rich vegetation of the Reptilian era.

SOUTHEAST PAVILION

FOSSIL REPTILES AND FISHES

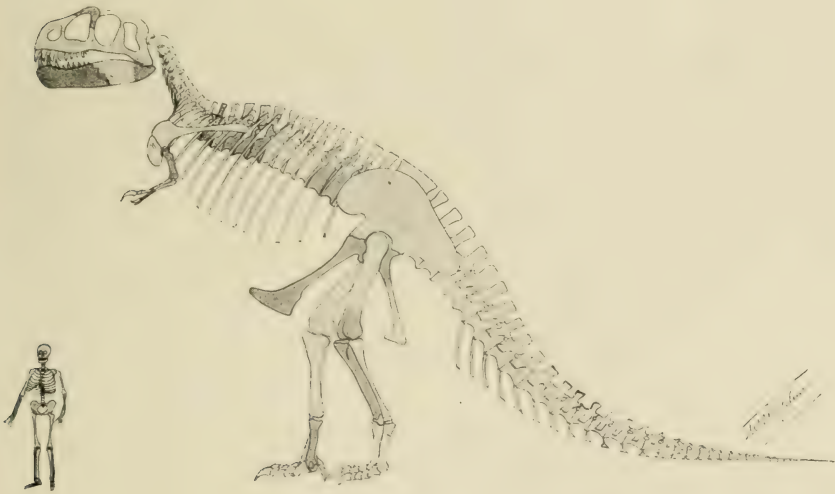
The visitor now enters the *Southeast Pavilion* containing the dinosaurs and other fossil reptiles and also fishes. These animals belong to a more ancient period than the specimens just examined. They lived from 3,000,000 to 10,000,000 years ago. They include the

The Dinosaur well-known dinosaurs of which the Museum has a large
Diplodocus collection. In the wall case on the left is a portion of the skeleton of the dinosaur *Diplodocus*; this was the first of these specimens to be unearthed by the Museum, while on the right is a nearly complete skeleton of a related species mounted as it lay when ten

million years ago it settled to the bottom of a western lake where it was gradually covered with sand and mud and slowly turned into stone.

The gigantic skeleton in the center of the hall is the huge extinct reptile, the dinosaur *Brontosaurus*, found in the Jurassic beds of Wyoming. It is the only mounted specimen of its kind in the world and more than two-thirds of the skeleton is the original petrified bone. It is sixty-six feet eight inches in length, sixteen feet in height and is estimated to have weighed when alive thirty-five tons. *Brontosaurus* is one of the largest giant reptiles and as is indicated by its teeth was herbivorous, probably living on the rank water weeds of the nearly sea-level marshes of Wyoming. Contrasted with the herbivorous

Allosaurus *Brontosaurus*, is the carnivorous dinosaur *Allosaurus*, mounted to represent the animal feeding on the fallen carcass of a *Brontosaurus*, upon which it preyed. This is not a fanciful mounting for these very skeletons were found in close proximity to each other in the Jurassic beds of Wyoming, and the skeleton of the fallen *Brontosaurus* shows gouges made by the teeth of *Allosaurus* as it tore the flesh from its victim.



TYRANNOSAURUS AND MAN

A man would have been but a mouthful for this the latest and largest of flesh-eating dinosaurs.

Near the *Allosaurus* group is a portion of a skeleton of *Tyrannosaurus*, the last and most powerful of the carnivorous dinosaurs. Like *Allosaurus* it has enormous three-toed hind legs, armed with sharp claws, and smaller forelegs. *Tyrannosaurus* is from Montana and the matrix in which it was found is as hard as flint.



TRACHODONS OR DUCK-BILLED DINOSAURS

Fossil reptiles, fifteen to sixteen feet high and thirty feet long, with spreading webbed feet, compressed tail and duck-like bill, all of which indicate a more or less aquatic existence.

To the left of *Brontosaurus* are two complete specimens of the duck-billed dinosaur *Trachodon*. One shows the animal erect and standing on guard, while the other is shown feeding on shellfish and plants of the Cretaceous swamps of Montana.

Mummied Most wonderful, perhaps of all the specimens shown
Dinosaur here is a "mummy" of *Trachodon* in which the texture of the skin is preserved.

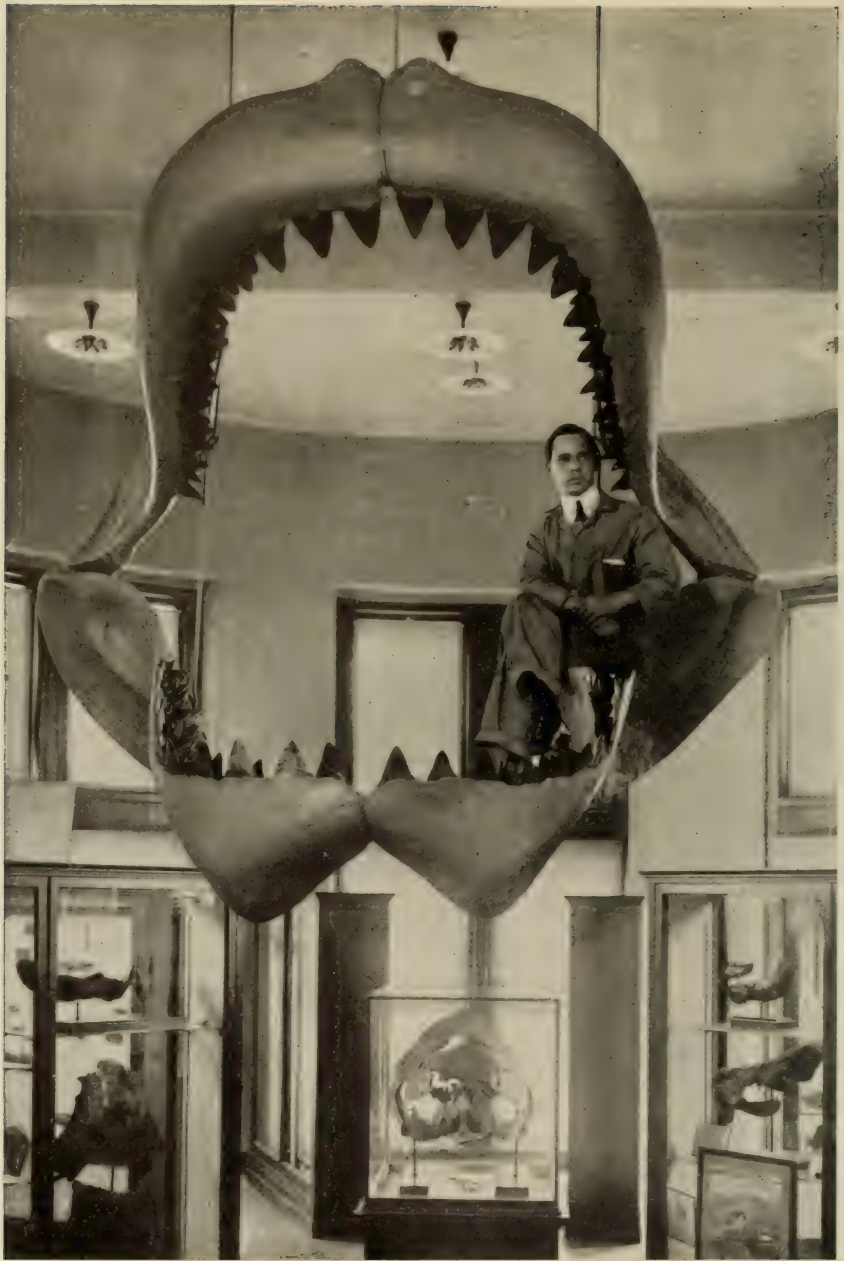
The animal is lying on its back and, in spite of its crushed condition, its form is easily distinguishable. It probably died on a sand bank or near a shoal where the hot winds dried up the flesh until the skin adhered to the bones like a close-fitting glove, and was subsequently buried by a flood.



Section of the skin of *Trachodon* showing the small scutes with which the animal was covered. About natural size.

Other specimens shown in the hall include the smaller carnivorous dinosaurs, the horned dinosaurs with, in one instance at least, a skull seven feet in length, and giant birds possessed of teeth. There is also the finback lizard, one of the most ancient of fossil reptiles; *Diadectes*, a reptile with a solid-boned skull and *Eryops*, a primitive amphibian. The finest collection of fossil turtles in the world will be found on the south side of the hall.

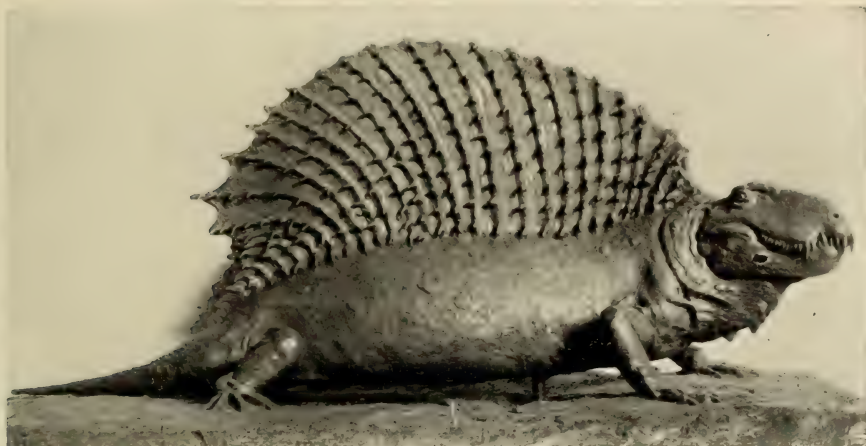
In the *Tower* of the Southeast Pavilion are displayed the fossil fishes which belong to a much earlier period than the mammals
Fossil Fishes and reptiles, some of them having lived twenty to fifty millions of years ago. Many of these forerunners of back-boned animals are quite unlike any living fishes and are probably only very indirectly related to them; some were small, curiously encased in shells; others, shown in the three cases in front of the visitor, attained large size and



RESTORATION OF THE JAWS OF A FOSSIL SHARK

This largest and most formidable fish, living or extinct, of which we have any record frequented the Coast of South Carolina in Tertiary time. The jaws measure nine feet across; estimated length of fish, eighty feet, as large as a sulphur-bottom whale.

were evidently formidable creatures. One of them in fact, *Dinichthys*, shown in the middle of the gallery, was probably among the most destructive creatures that ever lived in the sea. Its jaws were so strong that it could crush a plate of bone as thick as one's hand. Such an actual specimen, fractured in life and showing the marks of "teeth" is shown in a neighboring case.



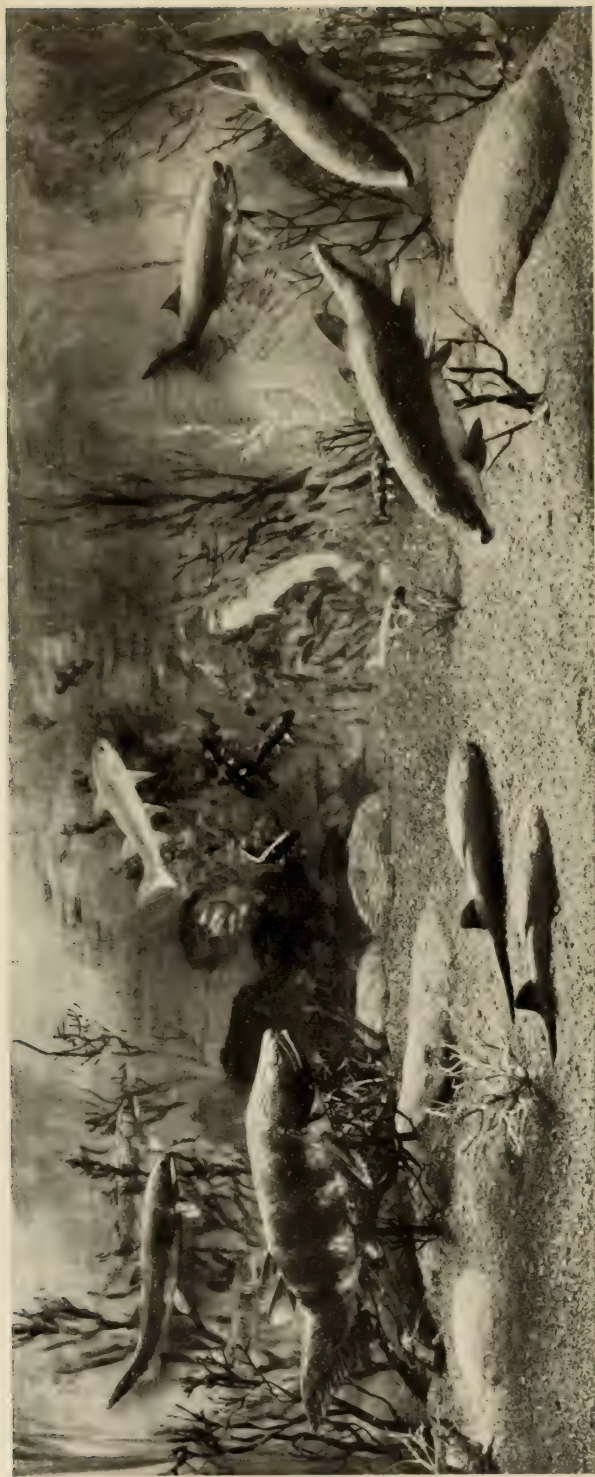
RESTORATION OF NAOSAURUS

One of Nature's jokes. Professor Cope, who was also a joker, suggested that the high fin served as a sail, by means of which Naosaurus sailed over the lakes near which it lived.

The collection is so arranged that he who makes the tour can see the principal kinds of fossil fishes and is able, in a measure, to outline the history and pedigree of the entire group. He can trace the rise and fall of the early plate-covered fishes; the era of the sharks which on the one hand supplanted the earliest fishes and were in time replaced by the more efficient lungfishes and ganoids; the age of ganoids when the waters were filled with these enamel-scaled fishes; finally the age of the bony-fishes, or teleosts, the multitudinous forms of to-day, the herrings, cods, perches, whose methods of swimming, feeding and breeding are far more efficient than those of any of their predecessors.

Above the entrance are the jaws (models), spreading nine feet, of a huge fossil shark in which the actual teeth are arranged as in the sharks of to-day, in the usual banks or rows—the teeth in the hinder rows serving to replace those in front, nature having dealt more kindly in the matter of teeth with sharks than with man. Such a shark probably measured from seventy to ninety feet and its race may well have become extinct, when for various reasons the enormous volume of food necessary to support it could not be maintained within its range of sea.

Jaws of
Giant Fossil
Shark



THE "FOSSIL AQUARIUM" IN THE FISH GALLERY, 1

This shows what can be done to make these ancient forms appear as living. The group illustrates the typical "Age of Fishes," Devonian, in which the forms came from a single locality (Cromarty) and a single rock layer in the Old Red Sandstone of Scotland. The seaweed is also a restoration, modeled from impressions of the same age. Cromarty is noteworthy, not merely for its deposits of Fossil Fishes, but for being the birthplace of Hugh Miller whose discoveries and descriptions did so much to make the fishes known alike to the scientific world and the general public.

Fossil Aquarium In the first alcove to the left, by the window, is a "fossil aquarium" in which a number of models of these earliest fishes are arranged in a group, as though alive in the sea.

In the next alcove are the early fossil sharks which superseded the tribe of plated fishes just mentioned. These sharks had soft skeletons, simple fins and a number of other primitive features which **Sharks** lead to the belief that all of the higher fishes, and the higher back-boned animals therefore as well, were descended from them, their simpler structures becoming more complicated in many directions. In one of the early sharks here exhibited, impressions of soft parts such as muscles and gill filaments have been preserved.

In the third alcove appear rare fossils of silver sharks or **Chimæroids**, which appear to have been developed from a primitive race of sharks. Curiously enough fossil egg capsules of these forms are sometimes preserved, and examples are here present. In neighboring cases are shown ancient lungfishes and ganoids—groups from which all land-living quadrupeds are believed to be descended.

In the fourth alcove are shown the ganoid fishes which dominated the **Ganoids** waters during the Age of Reptiles. They were of many kinds and sizes, most of them with lozenge-shaped scales of bone, with enamelled surface. One of the few survivors (*Amia*) of this ancient group is here shown living (in a window aquarium), to give the visitor a clearer idea of the fishes of the "Middle Ages" of the world.

In the fifth alcove are the petrified fishes of the Age of Mammals. By **Teleosts** this time nearly all of the primitive fishes, like sharks, lungfishes and ganoids, had become extinct; and the common forms were bony-fishes, or teleosts, closely related to our herrings, perches, mackerels and daces.

[Return to the South Pavilion or Hall of Mastodons and Mammoths.]

SOUTH CENTRAL WING

GEOLOGY AND INVERTEBRATE PALÆONTOLOGY

Turning northward at the center of the Quaternary Hall containing the mastodons and mammoths, the visitor enters the *South Central Wing* of the building and is in the Hall of Geology and Invertebrate Palæontology. Owing to important changes in the rearrangement of this hall, but a portion of the collections are at present on exhibition, though all are available for study. At the north end is a reproduction of a portion of the beautiful cave in the Copper Queen Mine at Bisbee, Arizona, while opposite, an elaborate model of the mine is being assembled.

At the entrance of the hall is that portion of the collections of meteorites which includes the smaller specimens. Nearby the visitor will see an exhibit illustrating some of the results of an expedition which the

Museum sent to Martinique and St. Vincent during the great volcanic eruptions of 1902-1903 that devastated those islands of the Lesser Antilles chain. A set of four relief maps shows the island of Martinique and its famous volcano, Mont Pelée, at three important stages of the eruptions, while the nearby cases and pedestals contain relics of the ruined city of St. Pierre and the dust, stones and bread crust bombs that were thrown out in a white hot or molten condition by this volcano and by the Soufrière of St. Vincent. Some 30,000 people were killed by these outbreaks. Important geological facts were learned from the observation and subsequent study of the series of events.

At the north end of the hall, there is the reproduction of part of a marvelously beautiful cave that was discovered early in 1910 in the mining operations at the famous Copper Queen mine at Bisbee in the southeastern part of Arizona. The cave was formed by the dissolving action of water traversing joints in limestone, and its walls, roof and bottom were afterward coated with calcite (calc spar) incrustations, stalactites and stalagmites, some of which are dazzling white while others are colored green with copper salts or pink with manganese compounds.

The visitor may see the stump and part of the roots of a large tree from an anthracite coal mine under Scranton, Pa. Millions of years ago, in the geological period known as the Carboniferous, this tree grew upon the top of a thick swamp deposit of decaying vegetation which ultimately became a most valuable bed of coal. The stump was left in the roof of the mine when the coal was extracted for commercial and domestic uses. It fell to the floor years after the gallery had been abandoned and was discovered only through the chance visit of a miner.

The cases along both sides and down the middle of the hall contain geological and palaeontological specimens. Palaeontology is the science of the ancient life of the earth; its field is the study of the fossilized shells and other hard parts and the various kinds of imprints left by the animals formerly inhabiting the seas and lands, and preserved in deposits which now form our stratified rocks. As normally the upper layers of a series of strata are more recent than the lower, the fossils reveal the succession of life forms in the earth's crust and thus are of the highest value and interest to the student of historical geology. Since, however, the remains of only a small proportion of the animals living at a given period are permanently preserved in the marine, river, lake and subaërial deposits of that period, the geological record of animal and plant forms is far from complete. Inasmuch as invertebrate animals are far less free in their movements than the vertebrate forms, they are accepted as the best determinants of the geological age of a bed of rock, even when remains of

both kinds are found together. Invertebrate life, too, appeared on the globe far earlier than vertebrate, and remains of certain species are abundant in the lowest (oldest) of our stratified rocks.

The specimens in the cases are arranged to illustrate historical geology, beginning at the northeast corner of the hall with the archæan rocks, which are the lowest and oldest of all and contain no fossils, advancing regularly southward along the east side through the Cambrian, Ordovician, Silurian and Devonian systems, passing to the west side of the hall in the Devonian and continuing through the Carboniferous, Jurassic, Triassic, Cretaceous and Tertiary. Thus far the specimens are from American localities, but the northwest quarter of the hall is devoted to a synoptic series of European fossils. The cases in the middle of the hall contain overflow material from the sides. The American series is subdivided into geographical provinces, the fossils from New York State and other eastern regions being placed first and then the material from the Central West and beyond. Under the geographical subdivision the species are arranged according to their position in the scale of life—that is, following a biological classification, the lower or simpler forms being placed first. The diamond-shaped bits of emerald green paper attached to some of the specimens indicate those, more than 8,000 in number, known as “types” or “figured specimens,” used by James Hall, R. P. Whitfield and others in the original description and naming of species or in their elucidation.

The upper shelves and ends of the wall cases contain particularly large or striking specimens of fossils, or blocks of rock illustrating the geological features of the horizons in which the fossils occur.

Two floor cases in the middle of the hall at the north end contain a series of rock specimens showing the geology of Manhattan Island and a very complete collection of the minerals found in New York City and immediate vicinity belonging to the New York Mineralogical Club.

Attention may be called also to the collection of Michigan copper ores, orbicular granites and diorites from several parts of the world, fossil crinoids from Waldron and Crawfordsville, Indiana, fossil corals from the Devonian reefs near Louisville, Kentucky, fossil crinoids and an immense clamlike shell from the Cretaceous of Nebraska, fossil plants from Tertiary beds at Florissant, Colorado. The windows contain some colored transparencies from photographs of interesting scenery in the West.

[Return to the Hall of Mastodons and Mammoths and turning to the right enter the West Corridor or Gem Hall.]



A PORTION OF THE GEM HALL

In the wall cases are many fine examples of quartz, calcite, malachite, azurite and amethyst. In the desk cases are cut and uncut diamonds, sapphires, topaz and other gems. The collection, presented to the Museum by the late Mr. J. Pierpont Morgan, includes many large and rare forms which could not be duplicated.



CRYSTAL BALL

WEST CORRIDOR

GEMS AND PRECIOUS STONES

Gems and Precious Stones The West Corridor contains the Morgan gem collection. This valuable series of gems and precious stones was presented to the Museum by Mr. J. Pierpont Morgan, one of the founders and a trustee of the institution. It comprises a representative assemblage of cut and uncut gems, many of the former of remarkable size and some of great purity of color. The installation aims to bring into juxtaposition, the cut and uncut material, the former is arranged around the latter, in the center of the cases, and the visitor may thus observe the brilliancy of effect produced in the natural mineral by skillful artificial treatment (cutting).

A partial gradation in importance and value is obtained by the arrangement of the gems, beginning with Diamond at the extreme south

and passing north, case by case, through Corundum (Sapphire), Beryl, (*Emerald*), Topaz, Tourmaline, Chrysolite, Spinel, Zircon (*Hyacinth*), Chrysolite (*Peridot*), Adularia (*Moonstone*), Opal, Amethyst, Kunzite, Amber, Pearls. In one case a varied collection of semi precious or ornamental stones is shown, many of which are experimental efforts to use mineral material which can never have any very extended use, viz., prehnite, titanite, sphalerite, hematite, cyanite, etc., etc.

Handsome wall case specimens of large size line the sides of the Gem room, among which the Azurite, Malachite, Quartz, Amethyst, Gypsum and Tourmaline are pre-eminent for size or beauty.

SOUTHWEST WING

MINERALS

Next beyond the Gem Hall is the *Southwest Wing* or Hall of Minerals. At the entrance to the hall is a case in which recent acquisitions are placed. The general collection of minerals consists chiefly of the well-known Bement Collection which contains specimens representing species of the known minerals of the world. Not only is the collection noted for its numbers, but in many instances the beauty and size of the individual specimens are quite unsurpassed in other collections.

The more attractive specimens are displayed in cases arranged down the center of the room. The remainder of the collection is arranged according to the classification of minerals. In the first cases on the right or left are models of the six systems of crystals and other introductory illustrations of the physical and optical properties of minerals. Each mineral has a characteristic form of crystallization which is one of the means of identifying it. The distribution of the more important minerals is indicated on maps.



PEARLS FROM FRESH WATER MUSSELS

SOUTHWEST PAVILION
COLLECTIONS FROM THE SOUTH SEA ISLANDS



HAWAIIAN FEATHER CLOAK

Entering the *Southwest Pavilion* beyond the Hall of Minerals the visitor will find specimens pertaining to the natives of the Pacific Islands. The wall cases contain examples of war implements, tapa or bark cloth, sacred masks, boomerangs and armor.

The central figure in this hall is a Tahitian priest represented as taking part in the fire-walking ceremony, in which the participants walk over heated boulders of lava. On either side are groups engaged in grating cocoanut, making kava, weaving mats for roofing houses.

**Tahitian
Fire-walker**

In the box case behind the Tahitian fire-walker there is exhibited a striking series of Melanesian masks, a few fashioned from the facial portion of human skulls, the majority carved of wood. These masks are worn by dancers during festivals in honor of the dead. Near the window there is a case of sacred Melanesian carvings topped by a totem pole that bears a superficial resemblance to the totem poles of the North Pacific coast of America.

The cases in the center contain Kava bowls, head rests, shell and ebony armlets and other ornaments, betel spatulas, ceremonial paddles, hats, mats and baskets. These people follow the custom of tattooing themselves. Their occupations as here detailed are peaceful rather than warlike. The swinging picture-frames on the left of the entrance midway down the room give some idea of the dress, customs, and pastimes of the South Sea Islanders.



GENERAL VIEW OF THE PHILIPPINE HALL

A noteworthy object is the cloak from the Sandwich Islands, made of red and yellow feathers. Such cloaks were worn by chiefs—cloaks of red feathers by priests, and those of yellow feathers by royalty alone. Each bird furnished but few feathers and, considering the value put upon them and the time required for making a cloak, the one shown represents a value of about \$500,000.

The entrance to the Maori Tower is flanked by two wall-cases with Australian material. There is a good series of boomerangs, and the very crude stone tools and weapons of the Australians are well represented.

The great boulder of jade, from New Zealand, supports the figure of a Maori warrior in an attitude of defiance, and in the room at his back is a fine series of dried, tattooed heads, gruesome relics of the time when Maori warriors preserved the heads of their vanquished enemies.

WEST WING

COLLECTIONS FROM THE PHILIPPINES

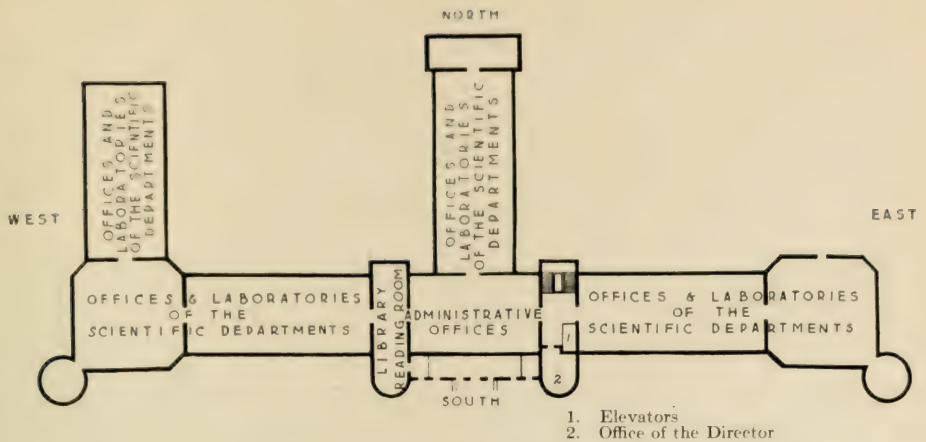
The hall due north beyond the Hall of the Pacific Islands is devoted to a collection from the Philippine Islands. The installation here, as in the African hall, is geographical. The specimens of wood along the walls are Philippine woods. The palm leaf mats above the windows around the hall are in some cases very beautiful. The brasswork, boar-bristle tooth brushes, necklaces, shell bracelets, knives, spears, bead-ornamented combs, medicines, guitars, horse accoutrements evidence superior workmanship. These people present a higher civilization than their South Sea Island neighbors. The exhibit of clothing distinctive of each tribe is very complete. The model at the entrance depicts a woman weaving a garment similar to some of those seen in the cases. The house in the tree at the end of the room, a life-size copy of a tree-house such as the Lake Lanao Moros build, will remind many visitors of the Swiss Family Robinson.

[Return to the elevators.]



THE MAORI WARRIOR

Cast from a living Maori in the pose of a defiant warrior. The boulder of jade on which the figure stands is the largest that has ever been brought from New Zealand.



FIFTH FLOOR

The fifth floor is given over to the administrative offices, the offices and laboratories of the scientific departments and the library which contains some 70,000 volumes on natural history, anthropology and travel.

The reading room of the library is located in the west corridor and, with the exception of Sundays and holidays, is open free daily, from 9 A.M. to 5 P.M., to all who may wish to consult the books. Besides the current issues of the more important periodicals, it contains the more general works of reference, while other volumes will, upon application to the librarian, be furnished to those who wish to consult them.

On this floor, too, are the workrooms of the Department of Vertebrate Palæontology, where the skeletons of fossil animals are prepared and mounted, and the laboratory where are made the beautiful models of invertebrates.

These, like the other laboratories, are of necessity not open to the public.

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POPULAR PUBLICATIONS
OF THE
AMERICAN MUSEUM OF NATURAL HISTORY

HANDBOOKS

These deal with subjects illustrated by the collections rather than with the objects themselves.

- No. 1.—NORTH AMERICAN INDIANS OF THE PLAINS. By CLARK WISSLER, Ph.D., Curator of Anthropology. October, 1912, 145 pages, maps and illustrations. *Paper, 25 cents; cloth, 50 cents.*
This gives an account of the Material Culture, Social Organization, Religion, Ceremonies, Arts and Languages of the Plains Indians of North America.
- No. 2.—INDIANS OF THE SOUTHWEST. By PLINY EARLE GODDARD, Ph.D., Associate Curator, Department of Anthropology. March, 1913, 190 pages, maps and many illustrations. *Paper, 25 cents; cloth, 50 cents.*
A résumé of our present knowledge of these interesting Indians. Among the subjects treated are the Spanish Conquest, Cliff Dwellings, Native Weaving, the Potter's Art and the Hopi Snake-dance.
- No. 3.—THE ANCIENT PEOPLES OF MEXICO AND CENTRAL AMERICA. By HERBERT J. SPINDEN, Ph.D., Assistant Curator, Department of Anthropology. Nearly ready.
- No. 4.—ANIMALS OF THE PAST. A popular account of some of the Creatures of the Ancient World. By FREDERIC A. LUCAS, Sc.D., Director of the Museum. 250 pages with 41 illustrations by Charles R. Knight and Joseph Gleeson. *Paper, 35 cents.*
This, now revised as one of the series of Museum Handbooks, tells of mammoth and mastodon, of the giants among birds, the sea lizards and the huge dinosaurs.

ILLUSTRATED GUIDE LEAFLETS

These describe some exhibit, or series of exhibits, of special interest or importance, or may deal with the contents of an entire hall.

Many of the earlier leaflets are out of print, but new editions of those most in demand are in course of preparation.

- THE COLLECTION OF MINERALS. By LOUIS P. GRATACAP, A.M., Curator of Mineralogy. February, 1902. *Price, 5 cents.*

The minerals have been moved since this leaflet was issued, but it contains much information about the collection and a number of figures of interesting specimens.

- NORTH AMERICAN RUMINANTS. By J. A. ALLEN, Ph.D., Curator of Mammalogy and Ornithology. *Revised edition, February, 1904. Price, 10 cents.*

Describes the rapidly disappearing large game of North America, such as the Bison, Elk and Mountain Sheep.

- THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By GEORGE H. PEPPER, Assistant in Anthropology. April, 1902. *Second edition, May, 1909. Price, 10 cents.*

PRIMITIVE ART. July, 1904. *Price, 15 cents.*

THE BATRACHIANS OF THE VICINITY OF NEW YORK CITY. By RAYMOND L. DITMARS, Curator of Reptiles, New York Zoölogical Park. October, 1905. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By FRANK M. CHAPMAN, Curator of Ornithology. April-July, 1906. *Price, 15 cents.*

PERUVIAN MUMMIES. By CHARLES W. MEAD, Assistant Curator, Department of Anthropology. March, 1907. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By EDMUND OTIS HOVEY, Ph.D., Curator, Department of Geology and Invertebrate Palaeontology. December, 1907. *Price, 10 cents.*

The collection, which represents about 500 falls, numbering some 2,000 specimens, includes the great "Ahnighito" meteorite, weighing 36½ tons, brought from Greenland by Peary, the strange "Willamette" meteorite and the "Canyon Diablo" which contains minute diamonds.

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By FRANK M. CHAPMAN, Curator of Ornithology. February, 1909. *Price, 15 cents.*

These celebrated groups are designed to illustrate not only the habits but also the haunts, or habitats, of the species shown. The backgrounds are careful studies from nature and each represents some definite locality. Twenty-two of these groups are shown in this leaflet.

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TREES AND FORESTRY. By MARY CYNTHIA DICKERSON, B.S., Curator of Woods and Forestry. September, 1910. *Out of print. A new edition in course of preparation.*

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No. 33.—THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By CHARLES-EDWARD AMORY WINSLOW, M.S., Curator, Department of Public Health. April, 1911, 25 pages, 13 illustrations. *Price, 10 cents.*

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No. 34.—PLANT FORMS IN WAX. By E. C. B. FASSETT. November, 1911. *Price, 10 cents.*

Tells how reproductions of foliage and flowers, such as are used in the bird groups, are made.

- No. 36.—THE EVOLUTION OF THE HORSE. By W. D. MATTHEW, Ph.D., Curator, Department of Vertebrate Palaeontology. *In press.* 63 pages, 39 illustrations. *Price, 20 cents.*

The past geologic history of the Horse affords the most complete and convincing illustration of evolution among mammals. This leaflet, based upon material in this Museum, describes the successive stages in its evolution from the four-toed "*Eohippus* no bigger than a fox" to the single-toed horse of to-day.

REPRINTS

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- THE ANCESTRY OF THE EDENTATES. By W. D. MATTHEW, December, 1912. 8 pages, 4 illustrations. *Price 5 cents.*

GUIDE TO THE COLLECTIONS ILLUSTRATED

New Edition issued July, 1913, 114 pages, 63 illustrations, many full page. *Price 25 cents.*

KEY TO THE COLLECTIONS

Contains plans of the different floors, notes, the chief objects of interest in the various halls, and describes briefly the study collections. *Price 5 cents.*

These publications may be purchased in the Visitors' Room, near the entrance, from the Attendants or from the Librarian.



AMERICAN MUSEUM OF NATURAL HISTORY

FOR THE PEOPLE

FOR EDUCATION

FOR SCIENCE

GUIDE LEAFLET NO. 37.

General Guide to the Exhibition Halls, American
Museum of Natural History. 1913

See,

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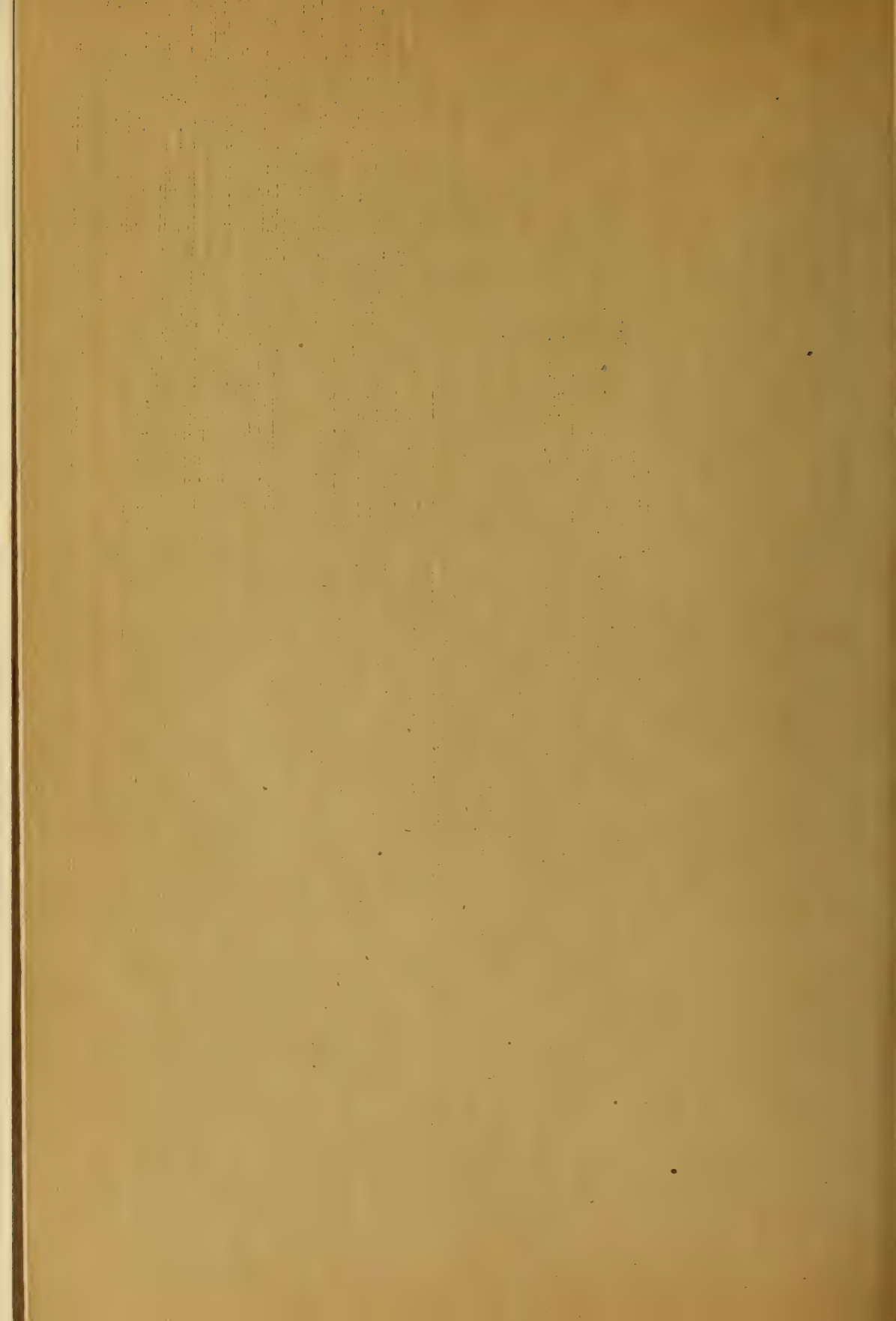
AMERICAN MUSEUM OF NATURAL HISTORY

OUR COMMON BUTTERFLIES



By F. E. LUTZ and F. E. WATSON

GUIDE LEAFLET No. 38



OUR COMMON BUTTERFLIES

BY F. E. LUTZ AND F. E. WATSON



AMERICAN MUSEUM OF NATURAL HISTORY

GUIDE LEAFLET SERIES No. 38

Third Edition

NEW YORK, SEPTEMBER, 1920

PRINTED AT THE MUSEUM

BUTTERFLIES are not only among the most attractive of Nature's subjects, but among the most abundant and most readily captured.

Many have collected them in their youth, and some have thus started on the path that leads to serious study in Natural History. Many more admire these bright-colored sprites flitting by the roadside and over the fields. To all these this leaflet is offered. It is an attempt to provide everyone with a simple means of identifying our most common butterflies, or more strictly speaking, those of our eastern states, and to afford a little information regarding them. And readers may feel relieved to learn that the caterpillars of butterflies, and even of our most beautiful moths, are rarely harmful — the greatest damage to foliage is done by the larvæ of dull-colored moths as if out of spite for the sombre dress Nature has bestowed upon them.

FREDERIC A. LUCAS

Director

American Museum of Natural History

June, 1914

Our Common Butterflies



The graceful flight and beauty of adult butterflies have made them the most popular of insects, but in their youth they have little beauty and can only crawl and eat. They are "horrid caterpillars," poisoned by gardeners and shunned by all except the few who see in them the possibilities of maturity. However, not all caterpillars develop into butterflies; the majority become moths, and some creatures which strongly resemble caterpillars are really quite different from either butterflies or moths.



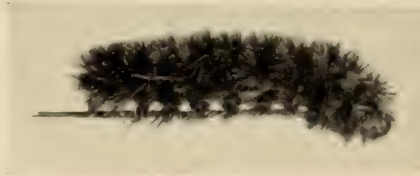
A YOUNG PAPILIO
Showing the two sorts of legs

A useful distinguishing characteristic of insects is the possession of three pairs of true legs. Nothing else which the amateur is likely to notice has just this number. Spiders have four pairs and centipedes have many; they are not insects. Now a caterpillar *appears* to have more than three pairs of legs, but it will be seen upon close examination that the three front pairs are the only ones which are jointed. The other "legs" are not true legs but merely fleshy props. Young leaf-feeding beetles do not have these props and young saw-flies (relatives of wasps) have five or more pairs in the middle of the body, whereas young butterflies have four pairs and a pair of claspers at the hind end of the body.



A PAPILIO WITH ONE WING SCALED

Both butterflies and moths belong to that division of insects known as Lepidoptera or "scaly-winged." When the minute colored scales which cover their wings are removed nothing is left but a semitransparent membrane supported by veins.



LARVÆ OF MOTHS

It is not possible to state concisely and in lay terms the difference between young moths and young butterflies. However, cut-worms, inch- or measuring-worms, fuzzy caterpillars, caterpillars with a single

OUR COMMON BUTTERFLIES

horn at the hind end, those which are larger than a man's little finger, and those which make nests are fairly certain to be young moths. A part of the rest are young butterflies.



A CHRYSALIS

When young *Lepidoptera* have eaten their fill once they cast off the skin they have been wearing and get a larger one. This process is repeated three or four times and finally they are full-grown caterpillars. Then, if they be young moths, they seek a suitable place and usually spin a cocoon of silk threads. Inside of this they moult once more but instead of becoming a larger caterpillar each turns into a mummy-like pupa. If they be young butterflies, the fundamental process is the same but no cocoon is made. The pupa, which is called a chrysalis, hangs naked. Perhaps the single thread around the body of some of them and the silk which fastens the tail to the supporting surface represent the moth's cocoon.

The distinction between adult moths and adult butterflies is largely a matter of habits and "feelers." The antennæ are a pair of appendages on an insect's head which are popularly called "feelers," although, as a matter of fact, insects smell and hear with their antennæ as well as feel. The antennæ of butterflies are thread-like and have a knob or

OUR COMMON BUTTERFLIES

swelling at the tip. The antennæ of many moths are clearly feather-like. In others the plumules are not visible to the naked eye and the



MOTHS

Showing two types of antennæ

antennæ look like threads but they almost never have a swelling at the end large enough to be confused with the knob of butterflies. Then, too, all our butterflies fly only in the daytime, while all but a very few of our moths fly only at night.

Largely White Butterflies

A largely white butterfly is a common sight and a guess that it is the Cabbage Butterfly (*Pieris rapæ*) will almost always hit the mark. There are really three kinds of white butterflies in the East whose young feed on cabbage. Two of them are natives, but the third was accidentally brought from Europe to the vicinity of Quebec about 1860.



EUROPEAN CABBAGE BUTTERFLY (*Pieris rapæ*)*
Male (upper and under sides), above; Female, below

Since that time, aided doubtless by further importations, it has spread over the whole country and, like its compatriot the English sparrow, seems to be driving its native relatives out of existence. The European Cabbage Butterfly has the tips of the upper side of the front wings black; there are two black dots on each of the front wings of the female and one on those of the male; the under side of the hind wings is yellowish and without markings.

With us the Mustard White, or Immaculate Cabbage Butterfly, has practically no markings on the upper surface of the wings, although in other parts of the country it is subject to many interesting variations.

*To aid in the identification of specimens all figures have been made as nearly as possible the natural size of the species shown



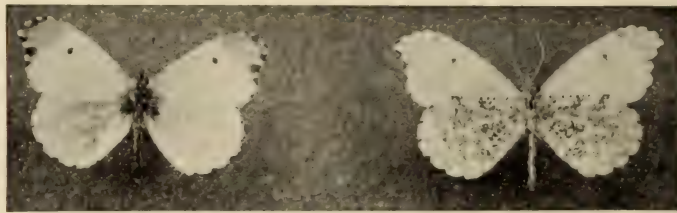
THE MUSTARD WHITE (*Pieris napi*)



CHECKERED WHITE (*Pieris protodice*)

Male, left; Female, right

The Checkered White, or Southern Cabbage Butterfly, has no definite black tips to the front wings but it has more than two black dots on the upper surface of each.



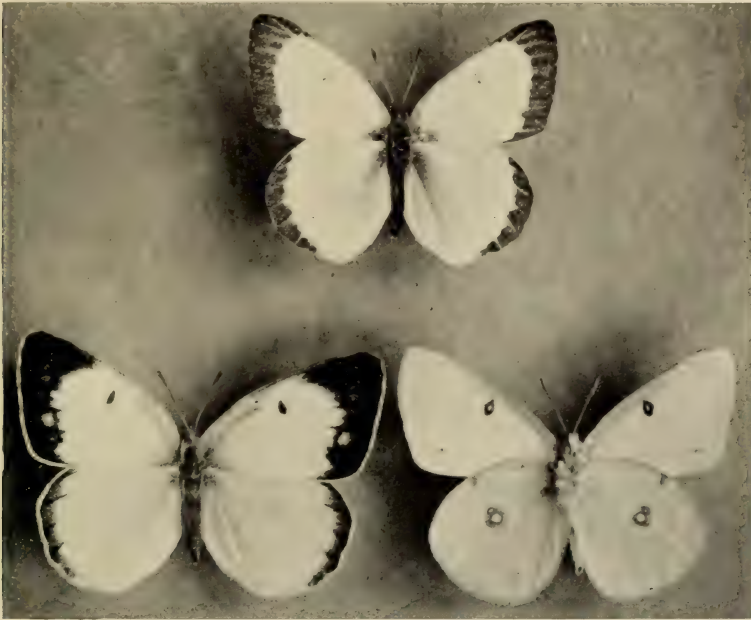
FALCATE ORANGE-TIP (*Euchloe genutia*)

Upper and under sides

This pretty little White may be recognized by the green marbling of the hind wings. It is called the Falcate Orange-tip from the shape and color of the front wings, although only the males are orange-tipped.

Largely Yellow Butterflies

There are several species of yellow butterflies which are closely related to the White just described. They nearly all feed on clover and its allies. It should be remarked parenthetically that when the food of a species is mentioned we mean the food of its young, for adult butterflies do not eat. At most they sip water from wayside pools or nectar from flowers through a coiled tube-like mouth which entirely lacks teeth or even jaws.



THE CLOUDED SULPHUR (*Colias philodice*)
Male above; Female (upper and under sides), below



THE LITTLE SULPHUR (*Terias lisa*)
Upper and under sides



THE TIGER SWALLOW TAIL (*Papilio turnus*)
Male, above; Female below

OUR COMMON BUTTERFLIES

The most common Sulphur in the Northeast has already been mentioned as being sometimes white. It is the Clouded Sulphur and may be distinguished from the Little Sulphur by the presence of silvery spots on the under surface of the hind wings. Furthermore, the former has a wing expanse of about two inches, while the latter is rarely larger than one and a half inches.

In completing the list of common yellow butterflies we reach the

Papilios or Swallowtails

These are the giants of our northern day-fliers. The conspicuous resemblance of their hind wings to the "swallow-tails" of the sartorial art and their large size distinguish them from all of our Lepidoptera except the pale green night-flying Luna. The Papilio which is largely yellow and has, among other black markings, three or four short black bands on the front half of each front wing is the Tiger Swallowtail. In a rare form of the female of this species the yellow is replaced by sooty brown except for the marginal spots.



THE DARK FORM OF THE TIGER SWALLOWTAIL



THE ASTERIAS SWALLOWTAIL (*Papilio polyxenes*)
Male , above; Female, below



THE SPICEBUSH SWALLOWTAIL (*Papilio troilus*)
Male, above; Female, below

The Asterias Swallowtail is about as common as the Tiger. Its young feed on parsley, carrot, celery and parsnip leaves. The adult male may be recognized by the row of yellow spots across the middle of the wings. These spots are sometimes reduced in the female to the extent shown here. The row of blue spots, inside the marginal yellow ones, is more distinct in the female than in the male.

Troilus has a single or at most an incomplete second row of yellow spots on the front wings. The hind wings are usually suffused with greenish. Its larvæ feed on sassafras and spicebush leaves.

The Small Blues



THE TAILED BLUE (*Lycaena comyntas*)
Upper and under sides

There is a delicate little blue creature (*Lycaena comyntas*) which has tails that may be seen by looking closely, but it is apt to be confused



THE COMMON BLUE (*Lycaena laron*)

with the Common Blue — its extremely variable relative. Both of them have several generations a year although the latter is frequently called the Spring Azure on account of its abundance when other butterflies are scarce.

The Rulers



THE BLUE EMPEROR (*Basilarchia astyanax*)

There are a number of butterflies whose common names signify high rank. The Blue Emperor is also called the Red-spotted Purple, the red spots being at the apex of the front wings on the upper side but more scattered on the lower side.



THE WHITE ADMIRAL (*Basilarchia arthemias*)

The White Admiral may be recognized by the conspicuous white band which crosses both dark purple wings.



THE MONARCH (*Danaus plexippus*)



THE VICEROY (*Limenitis archippus*)

The Viceroy is extremely interesting. Although related to the species just mentioned, it resembles to an astonishing degree the common and wide-spread but only distantly related Milkweed or Monarch Butterfly. Its general color is a tawny red; the wing veins are outlined in black, and there is a white-spotted black margin to the wings. So far, the description will fit either species but the Viceroy has a narrow black band across the middle of the hind wings which the Monarch lacks. Like other members of its genus it hibernates as a larva.

During early autumn the Monarch assembles in great swarms in the northeastern United States, large numbers hanging quietly from the leaves and branches of trees and shrubs. These flocks then move southward, suggesting the migration of birds. It is believed, but not positively established, that there are return migrants in the spring. At any rate, none of us have ever found the Monarch in the North during the winter, although its black and yellow banded larvæ with their long flexible "horns" and its gold-dotted delicate bluish-green chrysalids are as easily recognized as is the adult.

A group in the Museum's Insect Hall represents a portion of one of these autumnal swarms and gives a slight idea of the wonderful spectacle they present. The cover design of this leaflet is from a photograph of this group. If the Monarch were a favorite food of birds it is clear that such a gathering would be dangerous to the species concerned, as birds would find their prey very easy to catch. The fact that birds do not follow up these swarms has given rise to the belief that the Monarch is distasteful to them. Its larvæ feed on the leaves of milkweed, and the acrid juices of their food plant are supposed to impart an acrid flavor not only to the larvæ but through the pupæ to the adults. This is the way in which the Monarch is supposed to be protected from the birds.

The bright red color of the adult Monarch is believed to be a notice to birds that it is inedible. On the other hand the Viceroy is considered suitable bird food but it has acquired — by natural selection or otherwise — a color very similar to that of the Monarch, and the birds are usually unable to tell the difference so that the Viceroy is protected by mimicking the Monarch. It is interesting in this connection that Viceroys have been found in which the distinguishing black band on the hind wing is nearly or quite absent.

Other Reds and Browns



THE MOURNING CLOAK (*Vanessa antiopa*)
Upper and under sides

The Mourning Cloak, or, as the English call it, the Camberwell Beauty, is brownish, edged with light underneath and blue-black-brownish edged with yellow above. It is one of the few butterflies which pass our northern winters in the adult state, hidden securely away in a hollow log or under a pile of fence rails. Its spiny young feed on willow, poplar, elm and the like.



THE REGAL FRITILLARY (*Argynnis idalia*)
Upper and under sides

Three of our Fritillaries have a wing expanse of at least two inches. They are tawny or tawny red above, variously studded on one or both sides with silvery white spots. The upper surface of the hind wings of the Regal Fritillary is nearly black but the base is tawny



THE GREAT SPANGLED FRITILLARY (*Argynnis cybele*)
Upper and under sides

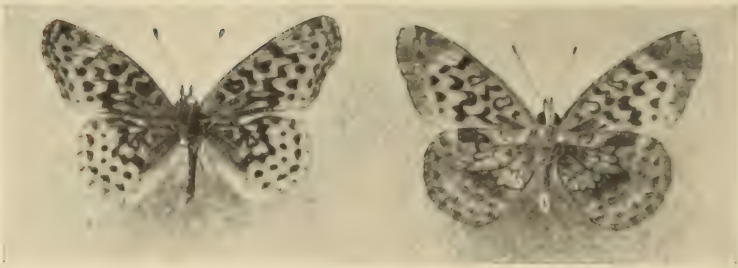
and there are two rows of light spots. Cybele and Aphrodite have no white markings on the upper surface and the wings are darker at the base than elsewhere although not at all black except for spots and



THE SMALLER SPANGLED FRITILLARY (*Argynnis aphrodite*)
Upper and under sides

irregular bands. It is difficult to distinguish between these two species, the chief difference being on the hind wings and in the smaller size of *Aphrodite*. All three of them feed upon violets, as do *Bellona* and *Myrina*, their smaller relatives.

OUR COMMON BUTTERFLIES



From above downward, upper and under sides of
THE SILVER-BORDERED FRITILLARY (*Argynnis myrina*)
THE MEADOW FRITILLARY (*Argynnis bellona*) and
THE PEARL CRESCENT (*Phyciodes tharos*)

The Pearl Crescent, which feeds upon asters, should be considered with the last two mentioned, for all have the upper side tawny, closely checkered with black, and all have a wing expanse of not much over one and a half inches. The under side of the hind wings of *Myrina* is spotted with silver, that of *Bellona* has no white markings and that of the Pearl Crescent is light yellow mottled with brown, a whitish crescentic spot near the middle of the hind margin being usually present and frequently accompanied by other similar spots.

OUR COMMON BUTTERFLIES

Angle-wings

The Angle-wings "look as if Mother Nature had with her scissors snipped the edges of their wings, fashioning notches and points according to the vagaries of an idle mood." The wing expanse is about two inches and while the upper surface is tawny, variously marked, the under surface is a combination of brown and gray which corresponds so closely with the color of dead leaves that an Angle-wing at rest on the forest floor is extremely well hidden.

The Violet-tip has a tail suggestive of the Papilios. The upper surface of this tail and the adjacent marginal portions of the hind wing are tinged with violet. On the under side of each hind wing there is a pair of silvery markings which are somewhat like an interrogation point. The young feed on elm leaves.

The Hop Merchant or Comma has a silvery comma or parenthesis on the under side of each hind wing and there is considerable yellowish color on the under surface of both pairs of wings. The first name given here refers to the feeding habits of the young.

The Gray Comma or Progne has a silvery marking similar to that of the Comma but smaller and the under surface lacks yellow. Its young prefer the leaves of currant and gooseberry.

The Angle-wings, like the Vanessas, hibernate as adults. They show considerable variation in their markings and general color. Several varietal forms have been considered worthy of special names.

Eye-spots

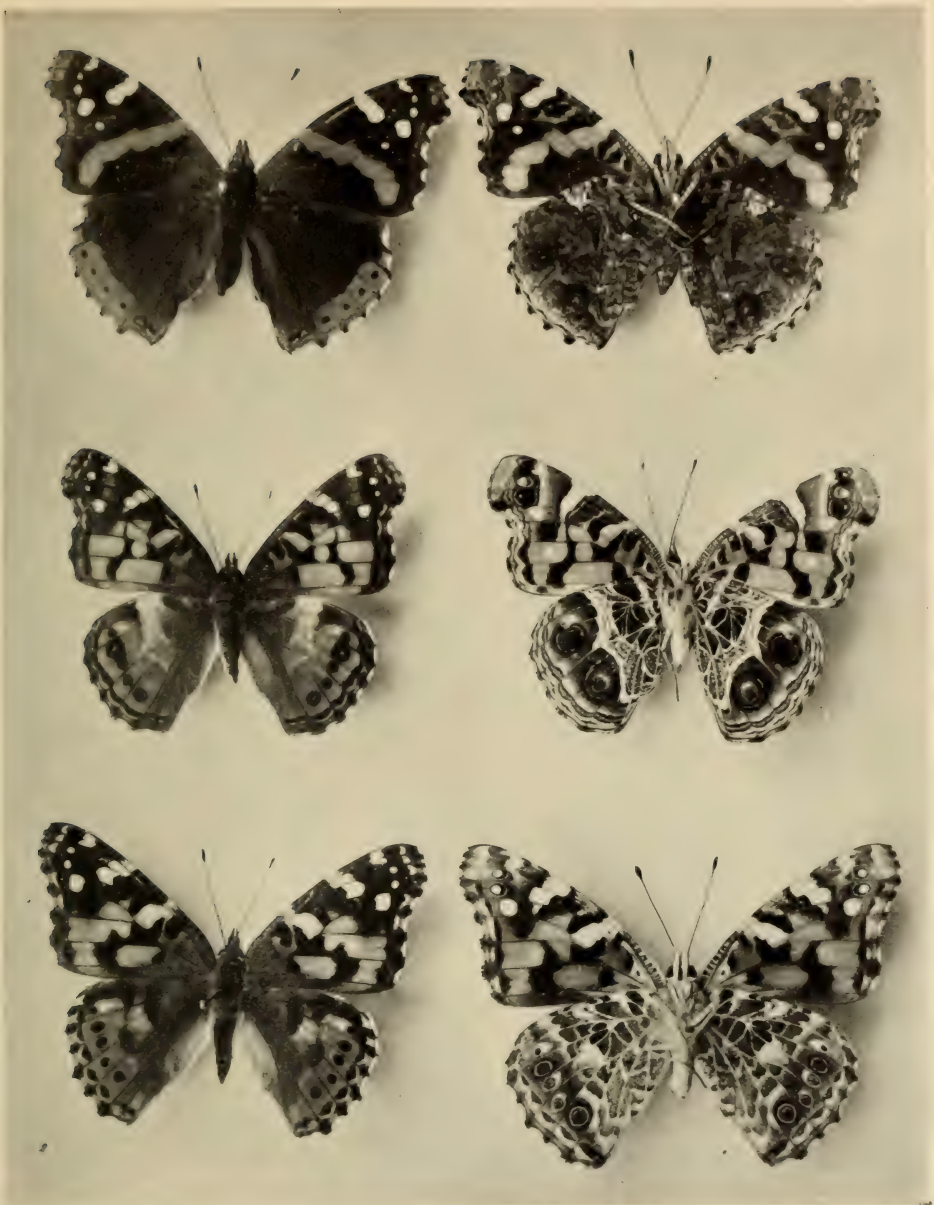
(An "eye spot" is a circular spot surrounded by one or more rings of a different color.)

The Red Admiral has such spots on the under side of the hind wings but they are usually very indistinct. This species can best be recognized by the brilliant red band crossing each black front wing.

Eye spots are very distinct on the under surface of the hind wings of Hunter's and the Thistle Butterflies. For some strange reason, these, but more particularly the latter, are also called the Painted Lady or Painted Beauty. The Thistle is one of the most widely distributed of butterflies — as widely as the thistles on which it feeds. There are usually four eye spots on each hind wing, below, which are smaller than the two of Hunter's.



From above downward, upper and under sides of
 THE VIOLET-TIP (*Grapta interrogationis*),
 THE HOP MERCHANT (*Grapta comma*) and THE GRAY COMMA (*Grapta progné*)



From above downward, upper and under sides of
THE RED ADMIRAL (*Vanessa atalanta*), HUNTER'S (*Vanessa huntera*) and
THE THISTLE (*Vanessa cardui*).

OUR COMMON BUTTERFLIES



THE COMMON WOOD-NYMPH (*Satyrus alope*)
Female and Male



THE COMMON GRASS-NYMPH (*Satyrodes canthus*) on the left
THE LITTLE WOOD-SATYR (*Neonympha eurytus*) on the right

The common Nymphs have eye spots on the upper side of the front wings. The general color is brownish. That of the Common Wood-nymph is dark but the eye spots of the front wings are set in a band of yellowish. There are not usually more than two, if any, spots on the upper surface of each hind wing.

The Common Grass-nymph has a row of four small spots on the upper surface of each front wing and the Little Wood-satyr has but two. The brown of both is rather pale and both have the spots on the upper surface of the hind wings "eyed." The young of Nymphs and Satyrs live upon grasses.

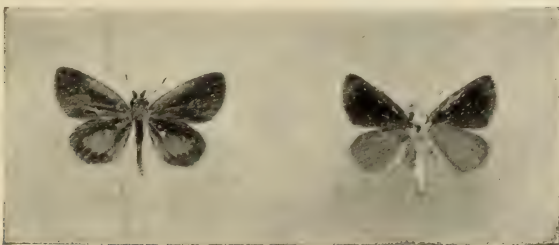
The Skippers

These butterflies, belonging to the family Hesperidae, get their common name from their rapid, darting flight. They are, for the most part, small and dull-colored. The sexes of some species differ in the markings on the upper side.



THE SILVER-SPOTTED SKIPPER (*Epargyreus tityrus*)
Upper and under sides

The Silver-spotted Skipper may be recognized by the large silvery spot on the under side of the hind wings. It is extremely pugnacious and will dash at any insect which flies near it.



THE LEAST SKIPPER (*Ancyloxypha numitor*)
Upper and under sides

Numitor is called the Least Skipper because of its small size. Its wings are tawny and dark brown. The front wings are generally dark above but have a light front margin below.



THE YELLOW-SPOTTED SKIPPER (*Polites coras*)
Upper (male and female) and under sides

The Yellow-spotted Skipper has bright yellow spots, as shown in the figure, on a brown ground color. These are brighter and larger on the under side of the wings. Other species have similar colors but the pattern is different.



THE VOLCANIC SKIPPER (*Catia druryi egeremet*)
Male, above; Female (upper and under sides), below

The Volcanic Skipper is very dark brown, with a greenish shade which is more pronounced on the hind wings.

The Mormon Skipper has two female forms. The typical one is tawny orange with dark brown border; the other (variety *pocahontas*) is darker and the markings are more obscure.



THE MORMON SKIPPER (*Atrytone hobomok*)
Male, above; Females (upper and under sides), below

In addition to those already mentioned, there are about twenty other species which are rather common in this vicinity, but longer and more technical descriptions than can be given here would be necessary for their easy identification. They are, for the most part, Hair-streaks and Skippers, small brownish or brown and yellow creatures which flit before our eyes and then, aided by their concealing colors, disappear.

On the following pages is a table which gives the approximate life-histories for this vicinity of the butterflies described here. These histories vary somewhat according to the locality and weather conditions. The cycle from egg — through caterpillar, chrysalis and butterfly — to egg is indicated by letters as follows: E = egg; L = larva or caterpillar; P = pupa or chrysalis; A = adult butterfly.

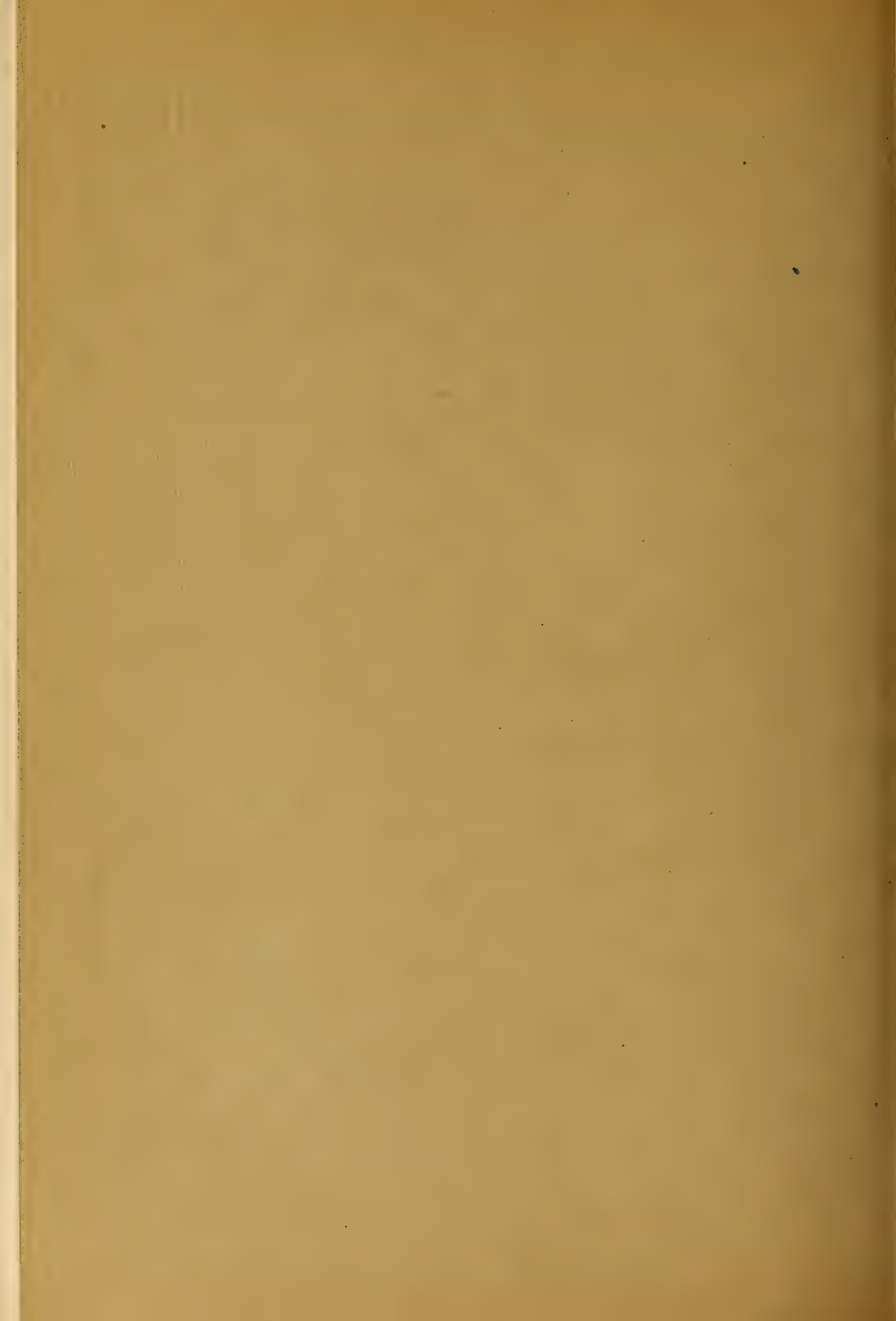
Readers desirous of collecting and preserving these or other insects will find simple directions for doing so in a leaflet on that subject published by this Museum. The Collection of Local Insects in the Museum may be seen upon application and the Curator will be glad to give those interested personal attention.

TABLE OF LIFE HISTORIES

NAME	Nov. to March	April	May	June	July	Aug.	Sept.	Oct.	Preferred Food-plant	HAUNTS
Cabbage Butterfly	P	PAE	AEL	PAEL	AELP	AELP	AELP	ALP	Cabbage	Gardens, Open Fields
Mustard White	P	AE	AEL	LPA	AELP	LPAE	AEL	LP	Two-leaved Toothwort	Open Woods, Wood Roads
Checkered White	P	AE	AEL	PAEL	AELP	AELP	AELP	ALP	Wild Peppergrass	Open Fields, Waste Places
Falcate Orange-tip	P	AE	AEL	LP	P	P	P	P	Lyre-leaved Rock-cress	Open Woods
Clouded Sulphur	LP	PA	AEL	AELP	LPAE	AELP	LPAE	AEL	Clover	Open Fields, Meadows
Little Sulphur	?	?	?	AELP	AELP	AELP	AELP	A	Sensitive Pea	Open Sandy Fields
Tiger Swallowtail	P	PA	AEL	LP	AEL	AELP	AELP	P	Wild Cherry	Open Fields and Woods
Asterias Swallowtail	P	P	AEL	LP	AEL	AEL	AELP	LP	Wild Carrot	Open Fields, Meadows
Spicebush Swallowtail	P	PAE	AEL	LP	AEL	ALP	AELP	LP	Sassafras	Open Fields, Woods, Meadows
Tailed Blue	L	PA	AEL	AELP	LPAE	AELP	AEL	L	Round- headed Bush-Clover	Open Fields, Meadows
Common Blue	P	AE	AEL	AELP	AELP	AELP	AELP	LP	Maple-leaved Arrow-wood	Open Woods
Blue Emperor	L	L	LP	LPAE	AEL	LPAE	AEL	L	Wild Cherry	Lanes, Orchards
White Admiral	L	L	LP	LPAE	AELP	LPAE	AEL	L	Black or Sweet Birch	Wood Roads
Monarch	Absent	Absent	AEL	LP	AEL	AELP	LPAE	ALP	Milkweed	Open Fields, Meadows
Viceroy	L	L	LP	AELP	AEL	ELPA	AEL	L	Willow	Damp Places, Meadows
Mourning Cloak	A	AE	AEL	LP	AEL	LPAE	AELP	LPA	Elm	Open Woods, Lanes
Regal Fritillary	L	L	L	LP	PA	AE	AEL	L	Violet	Wet Meadows
Great Spangled Fritillary	L	L	L	LPA	PA	AE	AEL	L	Violet	Wet Meadows
Smaller Spangled Fritillary	L	L	L	LPA	PA	AE	AEL	L	Violet	Wet Meadows
Silver-bordered Fritillary	L	LP	PAE	AELP	LPAE	LPAE	AEL	L	Violet	Wet Meadows
Meadow Fritillary	L	LP	PAE	AELP	LPAE	LPAE	AEL	L	Violet	Wet Meadows
Pearl Crescent	L	LP	AEL	AELP	PAEL	AELP	AEL	AL	Aster	Open Fields, Meadows
Violet-tip	A	A	AEL	AELP	AEL	AELP	LPA	PA	Elm	Open Woods, Lanes, Roads
Hop Merchant	A	A	AEL	AELP	AEL	AELP	LPA	A	Nettle	Open Woods, Lanes, Roads

TABLE OF LIFE HISTORIES

NAME	Nov. to March	April	May	June	July	Aug.	Sept.	Oct.	Preferred Food-plant	HAUNTS
Gray Comma	A	A	AEL	AELP	AEL	AELP	LPA	A	Currant	Open Woods, Lanes, Roads
Red Admiral	PA	A	AEL	AELP	PAEL	LPA	PA	PA	Nettle	Wood Roads, Lanes
Hunter's Butterfly	PA	A	AEL	AELP	PAEL	LPA	LPA	PA	Sweet or White Balsam	Open Fields, Meadows
Thistle	A	A	AEL	AELP	PAEL	LPAE	PAEL	PA	Burdock	Open Fields, Waste Places
Common Wood-nymph	L	L	L	LP	PA	AEL	AEL	L	Grasses	Grassy Meadows
Common Grass-nymph	L	L	L	LPA	PAE	AEL	L	L	Grasses	Wet Meadows, Swamps
Little Wood-satyr	L	L	PA	AEL	AEL	L	L	L	Grasses	Grassy Places, Edges of Woods
Silver-spotted Skipper	P	P	AEL	LPAE	PAEL	AEL	ALP	LP	Locust	Open Fields near Locust Trees
Least Skipper	P?	P	PA	AEL	PAEL	LPAE	AEL	P?	Grasses	Grassy Places, Fields & Meadows
Yellow-Spot	LP	LP	PA	PAE	AEL	LPAE	AEL	LP	Grasses	Grassy Places, Fields & Meadows
Volcanic Skipper	L	L (P?)	(LP?)	PAE	AEL	AEL	L	L	Grasses	Grassy Places, Fields & Meadows
Mormon Skipper	LP	LP	PA	PAE	AEL	L	LP	LP	Grasses	Grassy Places, Edges of Woods and Meadows



HOW TO COLLECT AND PRESERVE INSECTS

By FRANK E. LUTZ



American Museum of Natural History

Guide Leaflet No. 39

Fourth Edition

New York, October, 1920

Printed at the Museum

This Leaflet has been prepared by Dr. F. E. Lutz in response to numerous requests for information as to how to collect and preserve insects. To some extent it complements the leaflet "Our Common Butterflies," as that tells what the butterflies are, and this how to catch and take care of them and other insects.

There is a widespread but erroneous idea that collecting insects yields a satisfactory financial return. Those that still have this notion should correspond with the dealers mentioned on page 4. The amateur will profit greatly in health, pleasure and instruction, but should not approach nature with money in his eye.

FREDERIC A. LUCAS

Director.

American Museum of Natural History
June, 1914.

HOW TO COLLECT AND PRESERVE INSECTS

WHAT ARE INSECTS

"Insects are hexapodous tracheate arthropods," which doesn't help much unless it be translated, for the man who can translate it does not need to be told. On the part of laymen, however, and *this pamphlet is intended for laymen*, there is a good deal of haziness as to what are insects and what are not. Arthropods are creatures having jointed appendages but no internal skeleton. The group includes crabs, spiders and centipedes as well as insects. "Tracheate" refers to the structure of the breathing apparatus, but need not concern us here, for "hexapodous" settles the whole matter if one does not object to exceptions. An arthropod with no more than six legs is fairly certain to be an insect. The exceptions to this are minute immature forms not likely to be noticed by the reader. However, a young insect is an insect as truly as is a full-grown one, and while some young insects (flies, for example) have no legs, others (young butterflies, for example) have more than six legs. Perhaps if we call these exceptions maggots and caterpillars, enough will have been said. No mention has been made of wings, for two reasons: very many insects never have wings, and no insect has wings or even signs of wings when very young. It may be said here that when an insect does have fully developed wings it is full-grown. A small winged fly never grows up to be a larger fly, as many suppose. Most insects have an outwardly quiet stage, called the pupal, between the crawling larval and the flying adult ones, but many other insects remain active, merely gaining more and more fully developed wings at each molt. Compare in this respect the butterflies and the grasshoppers.

WHEN AND WHERE TO FIND INSECTS

An entomologist is frequently amused at being asked by well-meaning friends if he found anything when he went out. Insect hunting is a sport in which there are no blanks if you know the game. Frequently the most unpromising times and places are the best, for others have been discouraged by the outlook and you get what they have missed. We can never truly say that we know an insect's haunts until we can tell where to look for it every hour of every day in the year. If you wish to confuse an entomological friend, find out where an insect sleeps, then ask him if he knows, or request him as a favor to get you some common insects in the winter. Many insects are

great hidrs and should be looked for under bark; in rotten wood; under stones, dead leaves, etc.; among the roots of plants; in their stems and flowers—in short, everywhere at all times.

COLLECTING APPARATUS AND HOW TO USE IT

The great essentials for insect collecting were given each of us at birth and need only be improved by us—an inquiring mind, eyes and fingers. Only a very few insects sting to such an extent that collecting with unaided fingers is uncomfortable, and even the swiftest fliers can be caught by hand when they are young or asleep. However, certain tools are handy. They can either be made at home or purchased rather cheaply from dealers.¹

Mention of insect collecting immediately suggests a net. For the capture of adult butterflies, moths and other delicate flying creatures this should be of the lightest possible material. Fine Brussels net or bobbinet is used for the larger sizes (one or two feet in diameter) and silk veiling for the pocket sizes. The depth of this net should be at least twice the diameter of its rim, so that when an insect is caught a twist will fold the bag against the rim and leave the insect imprisoned in the lower end of the bag. Some collectors prefer green nets, believing that insects do not see them so well; and others black, because one can see through black netting readily; but most collectors use white. The beginner is apt to choose too long a handle and can then take only long slow strokes even if he does not get all mixed up with the vegetation and his fellow collectors. Three feet is long enough to handle, especially if one handles well the two feet which are covered with shoes.

The sweeping net should be made of stout white muslin or light duck on a strong rim well fastened to a handle of such a length that the user can just touch the ground with the rim of the net without stooping. The diameter of the net depends somewhat on the strength of the user and its depth may be from $1\frac{1}{2}$ -2 times its diameter. It is used to sweep blindly through the grass, bunches of flowers, light bushes, etc., in a fairly certain expectation of getting something. Much of the material will be damaged by the rough handling, but it is the quickest way to get large numbers of specimens, and the only way to get certain things quickly. The tendency seems to be to make the

¹The principal dealers in this vicinity are Kay-Scheerer Corporation, 56 West 23d St., New York City; Ward's Natural Science Establishment, Rochester, N. Y.; New Jersey Entomological Co., Box 432, South Amboy, N. J., and O. Foulde, 63 Fifth Ave., New York City.

handle of the sweep net too short, some on the market being only six inches long. These do not tire the arm so much as nets with longer handles, but you either miss the insects living near the ground or you get a very tired back. One useful trick in sweeping is to have a small cushion (about $2 \times 1\frac{1}{2}$ inches) of cotton covered with cheesecloth or muslin and a bottle of chloroform or ether. After sweeping for a few minutes moisten the cushion with the anesthetic, drop it into the net and quickly twist up the bag so that the fumes are confined. In a short time even the liveliest grasshoppers will be asleep and can be picked out and either saved or rejected. If rejected they will all shortly revive and walk, hop or fly away. The cushion is not strictly necessary as the chloroform may be put directly on the net after the insects are folded in the bottom.

The third net of the complete outfit is the water net. The bag should be of some strong material through which water will run readily. The rim should be strong and may be either circular in outline or flattened at the side opposite the handle. The advantage of the flattening is that the bottom of ponds can be skimmed, but the circular rim does fairly well, as the stirring of the water stirs up even the bottom insects and they are caught in the return swish of the net. A great deal of mud and weeds will also be caught, but devices to prevent this, such as covering the mouth of the net with a coarse wire screen, do not work well in collecting insects. After clearing the net of mud as much as possible by washing it through the net, dump the rest on the bank, preferably in the sun. Some insects will probably be seen at once, others will appear as the mass dries out. After you think you have found everything, wait a while and look out for very small beetles. Many collectors miss them.

Many or most of the nets that are for sale have folding rims and jointed handles. Opinion differs as to the best. When, as is often the case, lightness and ease of transportation are objects, it is well to have but one handle and frame with interchangeable bags. The landing net used by fishermen in which the frame consists of two pieces of flexible steel that lie close together when not in use is excellent. The two-jointed handle is better than the three-jointed one, as one of the joints of the former is just right except for high flying or deep diving quarry. In these cases add the second.

A sieve is handy for getting the small insects hiding under accumulations of dead leaves, in moss, trash, etc. Two sieves with meshes of different size are handier. A good plan is to have a strong

bag about a foot and a half square by two feet deep. About nine inches from the top sew pieces across the corners so that a piece of half-inch mesh wire screen can rest on them. Sift through this until there is quite a bit of fine material in the bottom of the bag and then retire to a comfortable place protected from the wind and spread a small sheet of white muslin or canvas. Now resift, using a mesh about four or five to an inch. The flat-bottomed sieves six or eight inches in diameter which are used for making French fried potatoes and the new wire pie-pans are excellent. Sift a very thin layer on to the white cloth and examine carefully the coarse stuff for relatively large things before it is thrown away. Be patient with the small stuff. Insects have a habit of "playing possum" and have plenty of patience themselves. They do not seem to like tobacco smoke. If you do, blow some on the litter. It will hasten matters—at least, smokers think so.

This is a good place to mention collecting forceps as they are almost necessary in picking up very small insects as well as insects concerning whose ability or inclination to sting there may be some suspicion. The best forceps for handling very delicate insects do not seem to be on the market. They are made of strips of German silver and have small but rounded points. However, the small steel ones which are on the market do very well. Steel forceps about a foot long are handy for picking caddice cases, etc., out of water, but they are of little use in general work. Dealers also carry forceps having gauze covered frames at the tips. They are meant for holding stinging insects while they are being examined, but they also are of very little use to the general collector.

A strong knife for cutting off galls, stripping bark, splitting infested branches, etc., is essential. A trowel is useful in following insect burrows or digging for root borers. The entrenching tool used in the army is a handy all-round substitute for trowel, hatchet, and large knife combined.

There are two chief methods of night collecting in general use: sugaring and at light. Another, while not so productive of specimens, is more interesting. It consists in simply prowling around with an acetylene bicycle lamp examining the centers of flowers, the underside of leaves, tree trunks, etc., to find out what the nocturnal insects are doing, and also where and how the day flying insects are passing the night.

There are about as many recipes for making the sugar mixture as there are for "mother's biscuits." Baking molasses usually forms the basis. Some additions are any combination or all of stale beer,

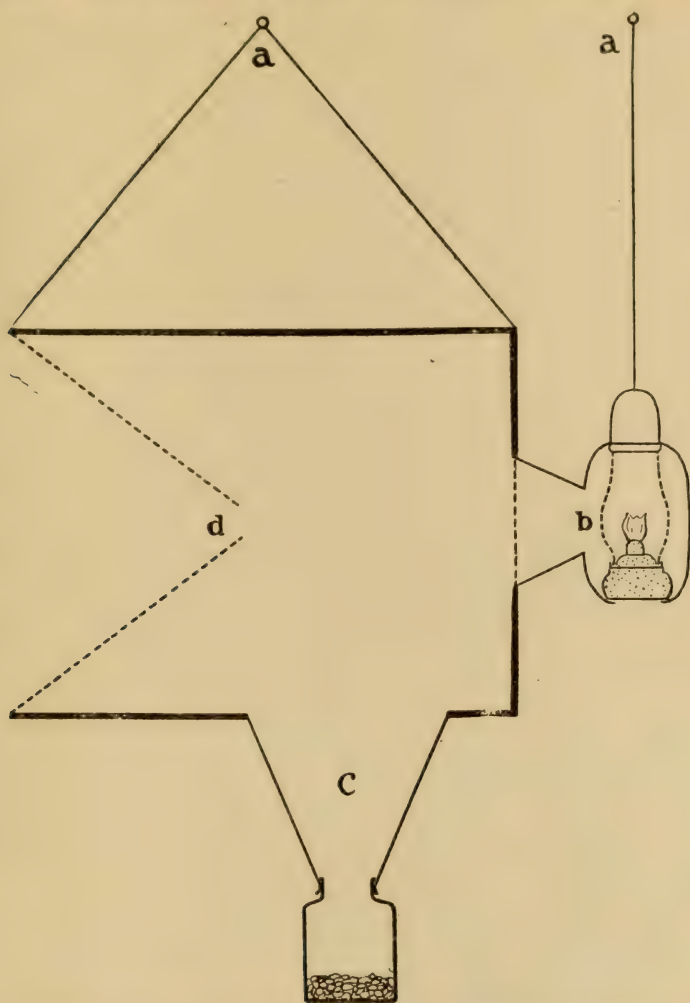


Figure 1. Diagrammatic section of a trap for insects which are attracted by light. *a*, Supporting strings; *b*, Lamp shut off from the trap by a glass plate or netting; *c*, Canvas bag with cyanide bottle; *d*, Glass plates or netting set at an angle. The space between the inner edges of *d* should be about one inch wide.

rum, asafoetida and brown sugar. The mixture should spread easily but not run badly. It is to be applied before dusk on tree trunks, fence rails and the like. Starting from some comfortable resting

place as a base, lay out a circuitous route, "sugaring" something every few feet and end at the resting place. After dark, if luck be good, the sugared strips will be full of moths, eagerly sipping the sweets. Several wide-mouthed cyanide killing bottles (see page 11) will be useful, but a net will be practically useless. It is well to have

a little ether in each bottle, and do not put a moth in a bottle until its predecessors have stopped fluttering. Only experience will teach how to catch these moths with a bottle. Some fly upward when disturbed and some fly straight out or sideways, but the majority drop a few inches before flying, so when in doubt hold the bottle slightly below the prospective captive.

Light attracts many sorts of insects besides moths. Street and porch lights are fruitful hunting grounds. A lamp by an open window makes the room it is in a splendid trap, or a smaller one can be fixed up and put "in the field." Figure 1 shows the principle. The details vary to suit collectors' whims. It is not difficult to make the box collapsible so that it can easily be transported. An ordinary barn lantern set in the center of a white sheet or a "bull's-eye" throwing a light against a sheet hung over a fence or between trees does very well. In the latter cases a net will be desirable but not easy to use. I have used, with great success, a white cheesecloth tent with a white muslin groundcloth. The best tent was A-shaped, open at each end except for inwardly projecting flies, and about 9 ft. \times 6 ft. \times 6 ft. high. One or two lanterns, placed inside, made it a good trap, while the outside served as illuminated sheets. Both light and sugar work best where there is a variety of vegetation as where wood-

land passes into swamp or where there is an abundance of second growth.

Many other sorts of traps have been devised. Olive bottles and fruit jars buried up to the neck in the ground and baited with molasses, meat, etc., are simple and effective. The insects

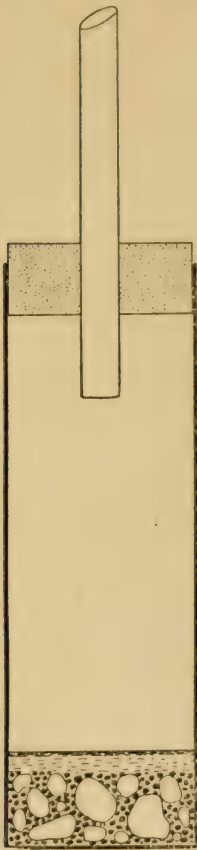


Figure 2. A collecting tube fitted with a quill for taking insects out of an umbrella.

caught in this way may be washed off in alcohol and will be nearly as good as new. Boards daubed on the under side with molasses or covering meat are not bad. Girdled branches and cut limbs hung up attract wood-boring insects which can then be collected by beating them into an upturned umbrella by sharply rapping the limbs with a stout stick. In fact an umbrella is a very useful piece of apparatus. Branches, both living and dead, are full of insects. The inverted umbrella catches what are knocked off but does not hold them for long. The collector must act quickly. Some collectors put a quill in the cork of a collecting tube as shown in Fig. 2. If the outer end of the quill be put over the insect it will crawl up through the quill and into the bottle, from which exit is difficult. If the umbrella be white, or at least lined with white, the insects can be more easily seen but so can the collector—not by the insects particularly, but by inquisitive humans—and the non-committal black does very well.

Beating will knock down many larvæ. Directions for preserving them are given on page 18. Some, at least, should be reared and here ingenuity is of more value than volumes of instructions. The beginner will doubtless be inclined to give his charges more light and air than necessary. Pasteboard show boxes are excellent for large caterpillars. Tin boxes keep the food longer and are easily cleaned but must be watched carefully or the food will mold. If the food plant can be potted, a good contrivance



Figure 3. A breeding cage. The flower pot holds earth which contains a growing plant or a bottle with fresh twigs. The lantern globe with a netting cover confines the insects.

is to slip a lantern globe over it, sinking the bottom far enough in the ground to prevent the escape of larvæ in that direction and covering the top with cheesecloth. Even if the plant cannot be grown, twigs can be kept fresh for some time by keeping their cut ends in a small bottle of water sunk in the ground and used inside a lantern globe. (See Fig. 3.) The twigs will be held in place and the larvæ prevented from drowning if cotton be loosely stuffed in the neck of the bottle

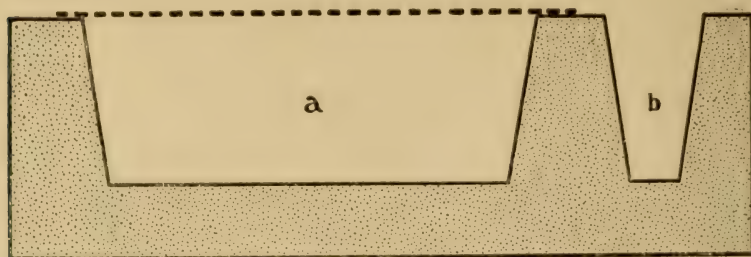


Figure 4. Section of a plaster breeding box. a, Space for insects; b, Space for water. The broken line represents a glass plate.

around the twigs. It is well to throw a thin layer of dirt over the cotton so that fallen larvæ can easily get back to their food. A useful device for certain larvæ (not leaf eaters) is shown in Fig. 4. It is made of plaster of Paris. The water at one end keeps the block moist. It is useful chiefly for ground-inhabiting larvæ or for galls. However, for the latter fruit jars with moist sand or a moist sponge in the bottom do just as well or better. Do not forget the larvæ living in hollow stems, dead wood and under bark.

KILLING

Up to this point but little mention has been made of killing insects and that was not really necessary. Insects can be studied alive with great pleasure and profit. However, there are so many kinds (about 15,000 in the vicinity of New York City, for example) and the differences between species are often so minute that it is well to kill and preserve samples at least. Fortunately this can be done with less trouble and less injury to the balance of Nature than is the case with most animals or even plants. Furthermore the collection can be made very attractive and instructive without taking up much space.

The best all-round killing agent for adult insects is cyanide of potassium. It should be broken into pieces varying in size from that of a small pea to that of a hickory nut, according to the size of the bottle to be used. Olive bottles make good medium-sized bottles, while fruit jars are better for large moths and butterflies. Tubes even

as small as $\frac{1}{4}$ inch in diameter by about 2 inches long are not too small for some things. Avoid bottles with strongly constricted necks. Avoid also bottles made of thin glass. There are many ways of keeping the cyanide in position and the bottle in good condition. The most general way is to pour a thin layer of plaster of Paris over a layer (from $\frac{1}{4}$ - $\frac{3}{4}$ inch deep) of cyanide. However, since such a bottle will quickly get too moist from the specimens and decomposition of the cyanide, some further device is almost always used. The pieces of cyanide may be wrapped in soft absorbent paper or imbedded in dry sawdust before the plaster is poured on. Another way is to imbed it in dry plaster before pouring on the wet. A piece of blotting paper should be fitted tightly over the plaster after it has "set." See Fig. 5. Some do not use plaster but imbed the cyanide in cotton and cover this with a piece of blotting paper or a

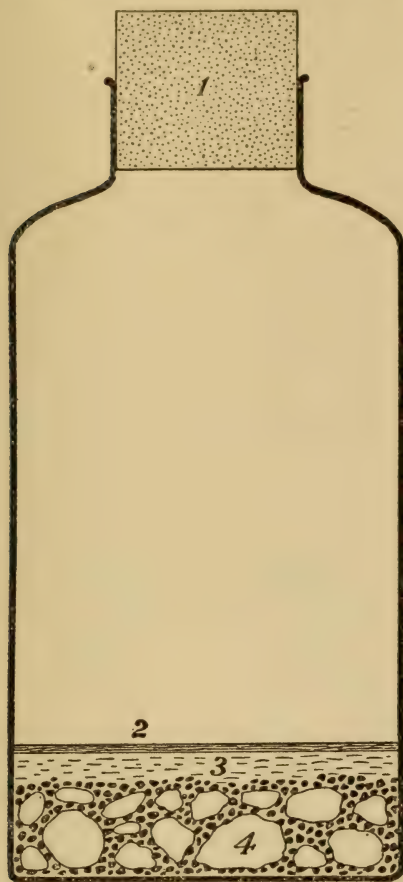


Figure 5. Diagram of a cyanide killing bottle.

- 1, Cork; 2, Blotting paper; 3, Plaster of Paris;
4, Pieces of cyanide in sawdust.

thin porous cork. A dangerous but otherwise fairly satisfactory method is to imbed a piece of cyanide on the inside surface of the cork and have none in the bottle itself. This bottle will be dry but not strong and as the cork will in time become saturated with poison

it will be very dangerous. It is always well to have a few narrow strips of loose absorbent paper in the bottle. They prevent injury to the insects by shaking and will keep the bottle dry as they can be frequently changed. As ordinarily made, a bottle should be allowed to ripen for several days before using. If wanted at once, put a few drops of vinegar or a pinch of boracic acid powder with the cyanide. Collectors of delicate moths and butterflies frequently put a few drops of ether or chloroform in their cyanide bottles before starting out. This is to quiet the insects at once, for the cyanide sometimes kills slowly. Experience will teach the collector that some insects die very slowly and revive after apparent death. On the other hand ether and chloroform make insects brittle and too long an exposure to cyanide fumes changes the color of some insects.

Practically all beetles and dragon flies, together with dull colored hairless insects of other orders, can be killed in alcohol and kept there indefinitely—50% is strong enough for killing and 70% for preserving. Higher grades make them brittle. No fly, bee, butterfly, moth or any green insect other than those previously mentioned should be



Figure 6. The black dots show where the pin should be inserted.

put in alcohol. In an emergency, kerosene, gasoline or benzine put on the thorax will kill and give satisfactory specimens. The thorax is the part of the body which bears the wings and legs. Insects breathe through holes in it and in the abdomen; not through the head. Pounded laurel leaves and peach pits make a weak killing agent, and butterflies and moths may be killed by carefully but firmly pinching the thorax between the thumb and finger, one on each side. In fact many collectors of these insects pinch their captures before taking them out of the net. This stops their injuring themselves by thrashing about.

MOUNTING

We come now to the methods of mounting and preserving. The stock method is pinning. The almost universally adopted pin is $1\frac{1}{2}$ inches long and has a very small head. It varies in thickness from extremely slender to as thick as an ordinary pin. The useful sizes are from No. 0 to No. 3. They are either plain "white" or enameled black. Much is to be said for both with the voting probably in favor of black. At any rate they should snap back when bent a reasonable amount. A pin that bends easily and stays bent produces profanity. Beetles are usually pinned through the right wing cover. All other insects, when pinned, are pinned through the thorax. In the case of flies it is well to pin a trifle to the right of the middle line as the bristles on the back are important in taxonomy and one side of the body should be perfect. True bugs should be pinned through the triangular portion of the thorax which is between the wings. See Fig. 6.

Very small insects are usually mounted on the tip of paper triangles, a medium-sized insect pin being stuck through the broad end of the triangle. The triangles are of about as many sizes as there are collectors. A ticket punch can be purchased which has a die suitable for cutting these triangles.

However if they be cut out with scissors or a sharp knife, such as a razor, a variety of sizes and shapes suited to different insects can easily be made. The best way is to cut tough, rather stiff paper into strips about three-eighths of an inch wide and then snip off triangles from them by making transverse cuts. It is well to pin up a quantity of these triangles in odd moments and keep them on hand. When

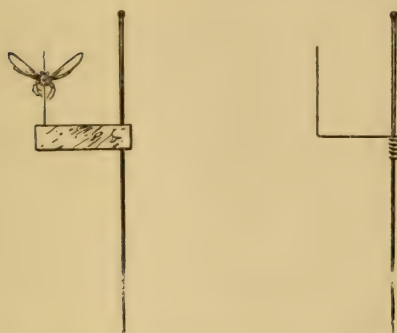


Figure 7. Pins for mounting small soft-bodied insects.

ready to mount, put a small bit of white shellac dissolved in alcohol or of some good elastic glue on the tip of a triangle and touch it to the under side of the thorax. Some difficulty will be experienced in keeping the insect straight on the point, especially if the adhesive be too thin. The triangles for ants should be fairly broad at the "point," and the front end of the abdomen as well as the thorax should be supported.

The method just mentioned is almost universally used for small beetles. Small flies and the like are frequently mounted on "minuten nadeln." These are short, very delicate, headless pins. Their use is illustrated in Fig. 7. Bits of pith, cork or firm blotting paper (used edgewise) serve to connect the two pins. In the illustration the "nadel" is shown stuck through the insect and then into the support. A somewhat better plan is to arrange a number in advance by sticking the "nadel" through the support from below, leaving the point sticking up; then mounting can be done rapidly by piercing the insects

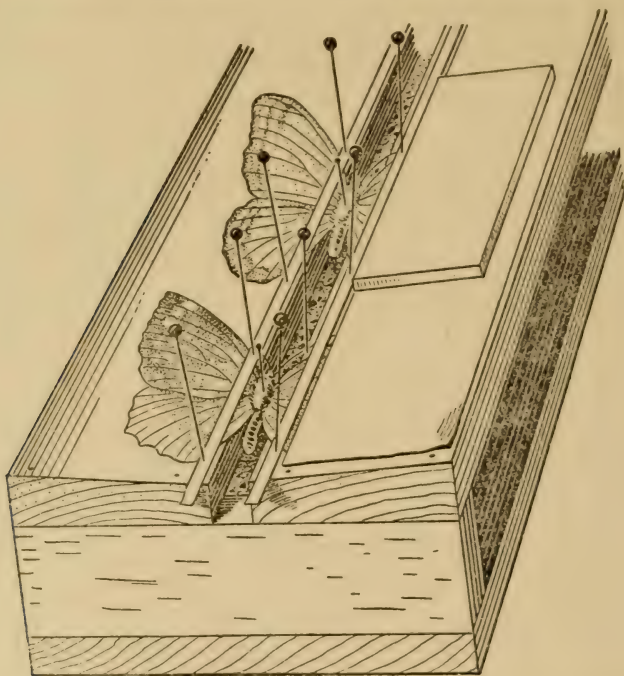


Figure 8. A common type of setting board showing different stages in "spreading."

from below. It is well, in this case, to stop before the point comes entirely through the back, as then no pin shows and furthermore the characters on the back are not marred. "Minuten nadeln" have the advantage over glue on triangles that the glue does not always hold. On the other hand, the "nadel" cannot be used with many hard-shelled beetles. Elbow pins (Fig. 7) are sometimes used but are not very satisfactory as a rule. The mounts mentioned in this paragraph are usually put on the left side of the pin.

The height of the insects on the pin is important for the final appearance of the collection. A strip of cardboard whose width is one-quarter to one-third the length of the pin makes a convenient gauge. With one edge held at the head of the pin, push the insect up until it touches the other edge. Or a block of wood containing a hole whose diameter is a trifle larger than that of the pin's head and whose depth is one-quarter to one-third the length of the pin may be used. Devices for regulating the height by sticking the point of the pin into a gauge are not satisfactory because of the varying thicknesses of the specimens.

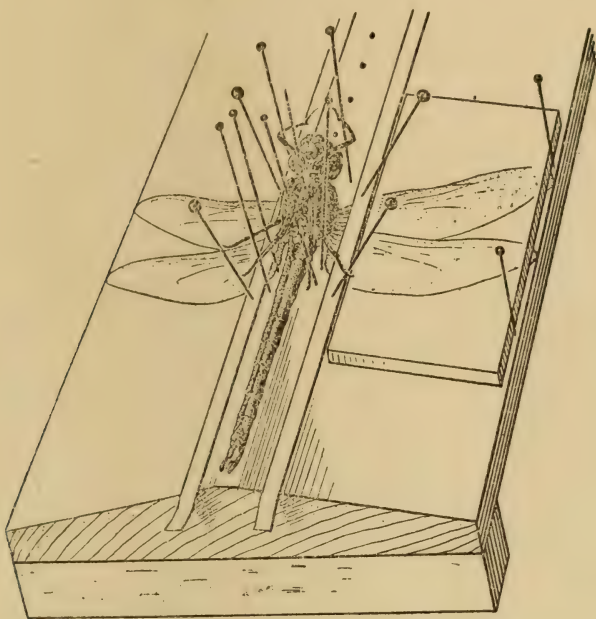


Figure 9. A setting board for use when it is desired to spread the legs.

Mounting insects in balsam on glass slides will probably not be taken up by the general collector unless he be already accustomed to making balsam mounts. It is, however, the only satisfactory method of getting extremely small mounts ready for study.

In collections, butterflies and moths usually have all four wings expanded to their utmost and more or less in line with the lateral axis of the creature's body. This makes a nice looking collection and is the best that can be done with most butterflies. However, many

moths have natural rest positions which are not only interesting but economical of space. It is well therefore to expand the wings of the left side so that the markings on both the front and hind wings show, but to leave the right wings in the natural rest position. The reason for expanding the left side rather than the right and for putting the triangles, etc. (see above) on the left side is that most people are right-handed. This arrangement makes it easy to use the pinning forceps with the right hand. Pinning forceps are strong forceps with broad roughened ends and are useful in pushing the pins into the cork of the storage boxes (see page 19). For the same reason when the wings of grasshoppers, wasps, etc., are spread it should always be the left wing.

The most common form of spreading board is illustrated in Fig. 8. The sides are made of soft wood. In the bottom of the central channel is a piece of soft cork. After pinning the insect, push the pin into this central cork until the back of the insect is nearly flush with the board. Then draw the wings to the desired position by means of forceps or a fine needle caught in the strong front margin of the wings. Never use the fingers on moths and butterflies as they will rub off the scales which cover the wings and give color to them. The wings may be held in position by means of fine pins or bits of heavy glass or strips of tracing cloth, held in place by pins placed outside of the wings. A combination of the last two methods, glass on paper, is best. It is well to have a number of boards with grooves of different widths for use with different sized insects.

Figure 9 shows a setting board devised by Mr. Chas. E. Sleight, of Ramsey, N. J.—and perhaps by others—for spreading caddice flies and other insects when it is desired to have the legs spread as well. The holes running down the center are just large enough to accommodate that part of the pin which is above the insect. The wings are spread as before except that now the under side is visible to the worker and the legs are accessible.

Flies (insects which have just one pair of wings), beetles (insects which have hard front wings) and bugs (insects which have the front part of the front wings leathery) are rarely spread although they may be. The wings on at least one side of wasps should not be spread, as the way they fold them is of taxonomic value.

Should insects get dry and stiff before they are spread they must be relaxed. This is done by putting them in a covered jar or tin box containing water or moist blotting paper. A few drops of carbolic

FIELD NOTES				DEPT. Nos.
FIELD NO.	ACCESS. NO.	DATE	TIME:	
4127			TIDE:	
LOCALITY Map			Temperature	
			Rainy Cloudy Pt. Cloudy	Clear Fog
ON, under, in				
SOIL: Rock, gravel, sand, clay, humus, mud; Moist, medium, dry				
SLOPE: Level, slight, moderate, steep, cliff; EXPOSURE: N-E-S-W				
VEGETATION:				
WATER: Stagnant, still, slight current, swift; Fresh, brackish, salt; DEPTH:				
CAUGHT BY — hand, sweeping, seine, dredging, sugar, light, trap, sifting, beating				
COLLECTOR:				
REMARKS:				

Figure 10. A field card such as is used at the American Museum

acid added to the water will prevent mold. Twenty-four hours will usually be sufficient to relax even the driest, but more time may sometimes be necessary. If the insect has neither scales nor hairs, it can be quickly relaxed by immersing it in warm water.

It will be noticed that both the setting boards illustrated here give the wings a slight upward tilt. If they keep this position it will not be objectionable, but they are not likely to do so, since the weight of the wings will probably drop them to the horizontal at least. Large insects dry more slowly than small ones and it will probably be necessary to allow them to remain on the boards for about two weeks. They should certainly remain until thoroughly dried. No further preservation is then necessary, as a rule, for the fairly hard-bodied adult insects. Some tropical grasshoppers have large abdomens full of fat and decomposing food. These should first be opened by an incision along the belly, the viscera taken out, and the abdomen stuffed with cotton. Broken specimens may be repaired with shellac or thin glue.

Caterpillars may be prepared in the following way: Make a circular incision at the hind end, cutting the intestine loose from the outer body wall. Then, laying the caterpillar on a piece of clean blotting paper, squeeze the viscera through this opening by gently rolling the caterpillar with a lead pencil, beginning near the hind end and gradually working toward the front. After the viscera have been gotten rid of, for the most part, insert a straw and fasten the first segment of the larva to the end of the straw by means of a fine needle. Draw the hind segment up the straw until the larva is natural length and fasten it in the same manner. Then inflate the larva by gently blowing through the straw. Since the front end of the straw may get plugged up it is well to make a small hole in the side of the straw before it is inserted. This hole had best come about midway between the larva's head and tail. Since inflation must be kept up until the larva's skin is dried, gentle heat is ordinarily used. A tin can with holes punched in it for ventilation and heated by an alcohol lamp makes a good oven, or one made for the purpose can be purchased. Dealers also sell bellows, tubing, clips, etc., to make the work of inflating easier. However inflated, green larvæ are apt to lose their color, for it is chlorophyll which fades rapidly. Slow drying paints relax the skin and distort it. Therefore, if painting is done, the pigments should be mixed with benzine or the like.

FIELD NOTES AND LABELS

It is only by the merest chance that the beginner gets a new or even a rare species on ground that has been worked over by experienced collectors, but even the primary class in entomology may add to our store of knowledge if it keeps field notes well. Date of capture and locality are considered of prime importance. They should always be known and kept with every specimen, but the distribution and time of appearance of our common species are known. It is of their habits that we are ignorant. What do they feed on? Under what conditions are they to be found when young and when old, day and night, winter and summer? What do they do and how do they do it?

A sample field card is shown in Fig. 10. The "Remarks" are really the important part. In using this card the lower right-hand number is torn off (after filling out the card *in the field*) and kept with the specimens to which the card refers until they are individually labeled. This is the card used in the American Museum. The stub is kept by the collector and the card is filed at the Museum. Such a refinement of system is not necessary in most cases, but some system is imperative if your collection is to be worth while.

The pin label should be small but legible. Certain firms make a business of printing these labels from small type, or the collector can make up a sheet by means of an ordinary typewriter (black ink is best) and have a block made from this greatly reduced in size. From this block any number of impressions can be made. Any printer will attend to the whole business. Figure 11 shows sample strips. If dates are not printed they should be filled in before cutting the labels apart. Field numbers can be written on the back of these labels or put on a separate label. The collector's name can

Fig. 11. labels or put on a separate label. The collector's name can also be put on a separate label. Similar labels should be the same height on the pin throughout the collection. This is easily accomplished by sticking the pin first through the label then into a hole of given depth or cork of a given thickness, thus pushing the labels up to a uniform height.

STORAGE BOXES AND CARE OF COLLECTION

Since certain members of a family of beetles (Dermestidæ) are given to eating dried insects, the storage boxes should have tight-fitting lids. Except for that almost anything will do. Cigar boxes

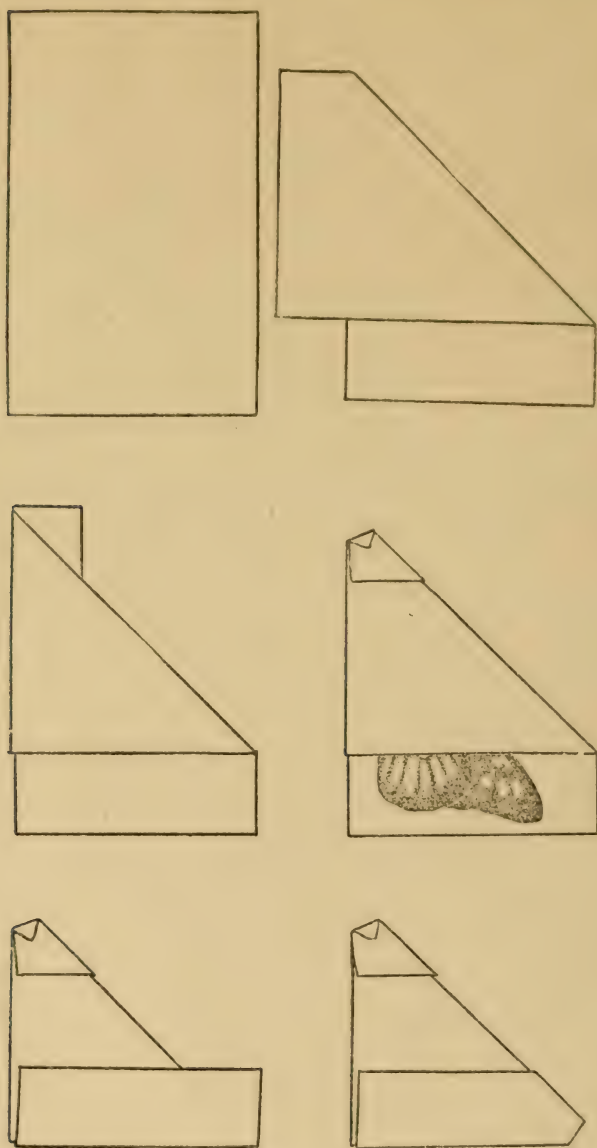


Figure 12. Method of packing a butterfly. The paper used in making the envelope should be stiff enough to protect the wings.

are not bad if carefully watched, but better boxes can be purchased at reasonable prices from dealers. Glass topped drawers are nice but not necessary. Whatever sort of box is used, the bottom, inside, should be covered with something which is soft enough to allow a pin to enter easily but which will hold the pin when it is once in. The compressed cork of the dealers is best. Sliced cornstalk is used by some beginners but two layers of corrugated paper, such as bottles are packed in, is better than corn pith. The layers should be placed so that the corrugations run at right angles to each other.

In spite of precaution Dermestids may get in, although camphor balls or flaked naphthalene will help to keep them out. If camphor balls are used, first heat the head of an ordinary pin and while hot push the head into the ball. When cool, it will be solid and the ball can be pinned into the box. If Dermestids do get in they may be killed by pouring into the box about a teaspoonful of carbon bisulphide and closing the lid down tightly. Remember that the bisulphide is very inflammable.

PACKING INSECTS IN THE FIELD

It frequently happens that the collector cannot attend to his catch at once, or possibly for months. Of course those things which are collected in alcohol may remain there. Butterflies and the like should be put into triangular envelopes. The manner of making these is shown in Fig. 12. Never put more than one specimen in an envelope. Other insects can be packed between layers of cotton and cheesecloth, with naphthalene flakes put in to keep out ants, etc., or they can be put in sawdust. In the latter case it is well to sprinkle carbolic acid on the sawdust to prevent mold. An excellent method of packing insects (except butterflies and moths) which are to be dried, is to make tubes of unglazed paper around a lead pencil, first writing the data on that part of the paper which comes outside. One end is closed by folding in the paper there, and then the tube is nearly filled with freshly killed insects. Finally the other end is closed by folding in the paper. These tubes and the triangular envelopes can be packed in a cigar box, and, if sprinkled with naphthalene to keep out ants and Dermestids, will keep indefinitely. Never pack moist insects in a tin box and never close even a wooden box tightly if there are many moist insects in it. Mold will result if you do.

IDENTIFICATION

Several popular leaflets for the identification of our more common or popular insects (e. g., butterflies) have been published by the Museum and may be purchased for a nominal sum. Others are being prepared and the study collections at the Museum are open to students upon application. *The Butterfly Book* and *The Moth Book*, both by Holland, are recommended for work in those groups. Blatchley's *Coleoptera of Indiana* is useful for students of beetles, except snout-beetles and their relatives, even along the Atlantic coast. For those beetles omitted in Blatchley, see Blatchley and Lang's book on *The Rhyncophora of the Eastern States*; both these books, however, are for professionals and advanced amateurs, rather than for beginners. Comstock's *Manual for the Study of Insects* and Kellogg's *American Insects* give good surveys of American entomology, especially as regards anatomy and the broader phases of the subject. The author's *Field Book of Insects* (Putnam's) is intended to answer "common questions about insects," and to enable the beginner to identify about 1,000 of the more frequently seen or more interesting species. Volumes V and VI of the *Cambridge Natural History* form the best world-wide treatise in English.

FINALLY

Do not forget that information about the insects is usually of as much value as the specimens— or more.

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THE AMERICAN MUSEUM OF NATURAL HISTORY was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people, and it is in cordial coöperation with all similar institutions throughout the world. The Museum authorities are dependent upon private subscriptions and the dues from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members.....	\$ 10	Patrons.....	\$ 1,000
Sustaining Members (Annual).....	25	Associate Benefactors.....	10,000
Life Members.....	100	Associate Founders (gift or bequest)	25,000
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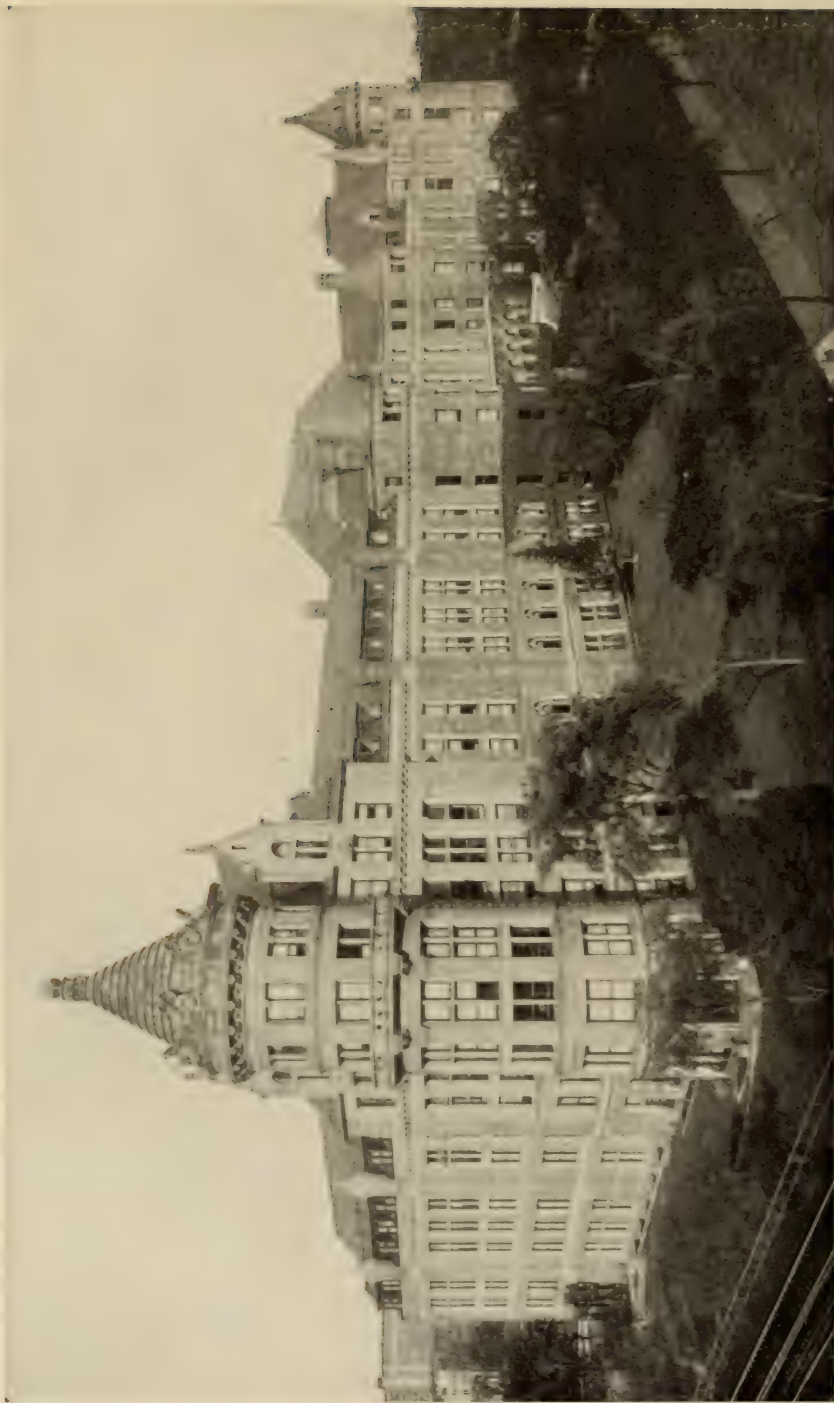
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THE AMERICAN MUSEUM OF NATURAL HISTORY OF WHICH THE CORNER STONE WAS LAID IN 1874 BY PRESIDENT U. S. GRANT

This is the Southern Façade which measures 710 feet from tower to tower. Eastern, western, and northern façades comparable with this in length are designed for the completed structure, which will be larger than any building in the world to-day even the Escorial of Spain or the National Capitol at Washington

GENERAL GUIDE
TO THE
EXHIBITION HALLS
OF THE
AMERICAN MUSEUM OF NATURAL HISTORY

BY
FREDERIC A. LUCAS, Director
Assisted by Members of the Museum Staff



GUIDE LEAFLET SERIES No. 40

MARY CYNTHIA DICKERSON, *Editor*

New York, November, 1914
Published by the Museum

The first General Guide to the Collections, comprising 54 pages and 16 illustrations, was issued in January, 1904.

The second General Guide, of 96 pages and 54 illustrations, was published in November, 1911.

The third edition consisted of 116 pages and 63 illustrations and was issued in July, 1913.

The present edition comprises 127 pages and 65 illustrations.

A list of the popular publications of the Museum will be found at the end, beginning on page 125.

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The halls are named according to the position they will have in the completed Museum building which will consist of four long façades facing east, west, north and south respectively, each connected with the center of the quadrangle formed, by a wing extending between open courts. Thus the hall at the eastern end of the south façade (the only façade completed) becomes the "southeast pavilion."

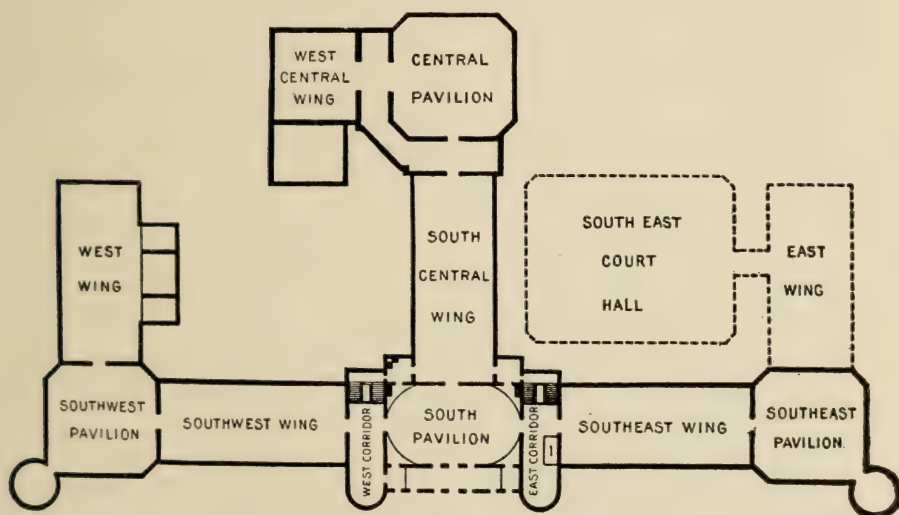
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Prefatory Note

It is the purpose of this GUIDE to call attention to the more important exhibits that the visitor will see as he passes through the halls. More detailed information regarding the specimens may be obtained from the labels or from the *Guide Leaflets*.

It is frequently necessary to rearrange the exhibits in order to provide space for new material or to put into effect advanced ideas regarding methods of exhibition, and as these changes are taking place all the time, it unavoidably happens that now and then discrepancies will be found between the actual arrangement of the exhibits and that noted in the GUIDE. Dr. Goode has said that a finished museum is a dead museum, and it is hoped that the visitor will look upon these necessary changes as indications of life and progress.



The halls are named according to the position they will have in the completed Museum building, which will consist of four long façades, facing east, west, north and south respectively, each connected with the center of the quadrangle formed, by a wing extending between open courts. Thus the hall at the eastern end of the south façade (the only façade completed) becomes the "southeast pavilion."

GENERAL GUIDE TO THE MUSEUM

INTRODUCTION

The History and Work of the Museum

THE American Museum of Natural History was founded and incorporated in 1869 for the purpose of establishing a Museum and Library of Natural History; of encouraging and developing the study of Natural Science; of advancing the general knowledge of kindred subjects and to that end, of furnishing popular instruction.

History For eight years its temporary home was in the Arsenal in Central Park. The corner stone of the present building in Manhattan Square was laid in 1874 by President U. S. Grant, and in 1877 the first section (South Central Wing) was completed.

Location The Museum is located at 77th Street and Central Park West, and can be reached by the 8th or 9th Avenue surface cars, the 6th or 9th Avenue elevated to 81st Street station, or by the subway to 72nd or 79th Street station. The Museum is open

Hours of Admission free every day in the year; on week days from 9 A. M. to 5 P. M., on Sundays from 1 to 5 P. M.

The Museum building is one of the largest municipal structures in the City, and has cost approximately \$5,000,000. The South Façade is 710 feet in length; the total area of the floor space is 470,789 square feet, or about 10 acres, of which 271,886 square feet are open to the public. The building when completed is designed to occupy all of Manhattan Square.

The building is erected and largely maintained by the City, through the Department of Parks. Building funds are provided for
Administration and Support by issues of Corporate Stock, which have been made at intervals since 1871. The annual appropriation, known as the Maintenance Fund, is devoted to the heating, lighting, repair and supervision of the building and care of the collections.

The Museum is under the control of a self-perpetuating Board of Trustees, which has the entire direction of all its activities as well as the guardianship of all the collections and exhibits. The Trustees give their services without remuneration.

The funds which enable the Trustees to purchase specimens, to carry on explorations and various forms of scientific work, to prepare and publish scientific papers and to enlarge the library are raised by contributions from the Trustees and other friends. These contributions come from three sources—namely, (1) the Endowment Fund, (2) Membership Fund, (3) voluntary subscriptions

The interest of the Endowment Fund, which includes the magnificent bequest of Mrs. Jesup, may be used for additions to the collections, research, and for publication. It can not be used for the care or repair of the building, construction of cases or other maintenance work, that is properly the province of the city to provide for.

The Membership Fund, derived from the subscriptions of Members, may be devoted to any purpose and is of particular importance in the educational work of the Museum.

Voluntary contributions may be used for general purposes or for such special object as the donor may designate; some of the most valuable and important collections have been obtained by such gifts.

There are at present about 3,700 Members. Annual Members contribute \$10 a year for the support of the Museum; Life Members make a single contribution of \$100. Membership fees are of great service in promoting the growth of the institution.

In the last edition of the Century Dictionary a museum is defined as:

Definition of a Museum "A collection of natural objects, or of those made or used by man, placed where they may be seen, preserved and studied. Neither the objects themselves, nor the place where they are shown constitutes a museum; this results from the combination of objects, place and purpose, display being an essential feature. The objects, or specimens, may be shown for general purposes only, or for the illustration of some subject or idea, the tendency of modern museums, being by the display of objects and the manner in which they are arranged and labeled to illustrate some fact in nature or in the history of mankind."

And E. Ray Lankester has very clearly stated that:

Purposes of Museums "The purposes of a great national museum of natural history are (1) To procure by its own explorers or by the voluntary assistance of independent naturalists the actual specimens upon which accurate knowledge of the animals, plants, and minerals of the earth's surface, and more especially of the national territory, is based; to preserve and arrange these collections for study by all expert naturalists, and to facilitate, directly or indirectly, the publication (in the form of catalogues or monographs) of the knowledge so obtained—with a view to its utilization, not only in the progress of science, but in the service of the State. (2) To exhibit in the best possible way for the edification of the public, at whose charges these collections are made and maintained, such specimens as are fitted for exposure in public galleries, with a view to the intelligent and willing participation of the people in the maintenance of the Museum."

The Museum not only maintains exhibits "for the edification of the public," but supplements the educational work performed by these and their accompanying labels, by lectures and publications of a popular nature. A course of evening lectures is given every Spring and Fall for the Members, to which admission is to be had by ticket; another series of lectures, free to the public, is given in conjunction with the Board of Education on Tuesday and Saturday evenings. Still another series, under the direction of the Museum's Department of Public Education, is given for the children in the Public Schools, and there are special lectures for the blind provided for by the Thorne Memorial Fund. The educational work of the Museum is carried still farther by means of its circulating collections for illustrating nature study which are sent free to the schools of Greater New York. The extent to which these collections are used is shown by the following statistics for the last five years:

	1909	1910	1911	1912	1913
Number of Collections in use	435	390	512	537	597
Number of Schools of Greater New York Supplied	419	334	486	491	501
Number of Pupils studying the collections	922,512	839,089	1,253,435	1,275,890	1,378,599

The scientific side of the work of the Museum is based upon its explorations and study collections.

The Study Collections, as the name implies, are not only for the benefit of students but preserve a record of our vanishing animal life and of the life and customs of our own and other primitive peoples.

In the case of Natural History the vast majority of the specimens are in the study series, not only because they would ultimately be ruined by exposure to light but because the display of all material would only confuse the visitor. Moreover, no museum has room to show everything, and a careful selection is made of objects of the greatest educational value and these are so displayed as to enhance their interest and attractiveness.

The Study collections are, briefly, as follows;

Anthropology.—*ETHNOLOGY.*—On the attic floor of the west wing and the northwest pavilion there are thirty-three fire-proof store rooms containing the ethnological study collections of more than 100,000 catalogue numbers, comprising extensive series for the Philippine Islands, Siberia, China, Pacific Islands, Africa, South America and the various culture areas in North America.



CHILDREN STUDYING MOOSE GROUP
Illustrating the use of the museum by the public schools

Archæology.— In archæology there is a large type series of stone objects from the various States of the Union. Full collections from excavated sites in British Columbia, Washington State, New York State, Kentucky, Arizona and New Mexico are here, together with a special series from the Trenton Valley. There is much material from Mexico, Peru and Bolivia.

The human skeleton material is chiefly from western States and South America. About two thousand crania have been classified and made available for study.

Geology and Invertebrate Palæontology.— The study collections comprise, among other things, the Hitchcock series of rocks illustrating thirteen geological sections across the States of Vermont and New Hampshire; a complete set of duplicate specimens from the United States geological survey of the Fortieth Parallel; a series illustrating the early geological survey of Pennsylvania; a complete typical series of rocks and microscopic thin sections illustrating Rosenbusch's manual of petrography; large series of American rocks; a complete series typifying the rocks encountered in driving the Simplon tunnel, Switzerland; many ores and economic specimens.

Invertebrate Palæontology.— Great numbers of fossil invertebrates, too numerous and varied to particularize, but representing many of the important groups.

Ichthyology and Herpetology.— **ICHTHYOLOGY.**— The collection of fishes comprises about 7,000 catalogued specimens, preserved in alcohol and kept in tanks and jars.

The fossil fish collection is one of the largest, if not the largest, in America, comprising about 10,000 catalogued specimens; it includes the Newberry, the Cope and several smaller collections.

HERPETOLOGY.— The collection of frogs, salamanders and reptiles numbers 9,000 specimens.

Invertebrate Zoölogy.— **GENERAL INVERTEBRATES.**— About 60,000 specimens of protozoans, sponges, polyps, starfishes, sea-urchins, worms, crustaceans, spiders, myriapods and chordates.

INSECTS.— (a) Local collection comprising insects known within fifty miles of New York City. (b) General collection including more than 500,000 specimens, among them the types of many species.

SHELLS.— The chief Molluscan collections of the Museum, exclusive of fossils. About 15,000 species are represented, comprised for the most part of the Jay and Haines collections.

Mammalogy and Ornithology.— **MAMMALOLOGY.**— The study collection of mammals contains about 25,000 skins, skulls and skeletons. It is especially rich in South American forms. Mexico and the Arctic are well represented; from the latter region there is a large and unique series of the beautiful white Peary's caribou and of the Greenland muskox, comprising about 150 specimens. The collection of whales is likewise noteworthy.

Ornithology.—The study collection of birds consists of approximately 90,000 unmounted skins, about nine-tenths of which are from the Western Hemisphere, and several thousand nests and eggs. South America is chiefly represented by a large collection from Matto Grosso, Brazil, and extensive collections from Colombia; also smaller series from Ecuador, Peru, Venezuela and Trinidad.

From North America, there are important collections from Mexico, Nicaragua, California, Texas, Arizona and the Middle Atlantic States—the Rocky Mountain region being most poorly represented. Of special collections, the George N. Lawrence and Maximilian collections are of special importance from the hundreds of type specimens which they contain.

Mineralogy.—Most of the mineral specimens are on exhibition, but the overflow from the public cases forms a study series of no mean proportion.

Public Health.—Living bacteria are maintained and distributed free to recognized laboratories.

Vertebrate Palæontology.—The study collections comprise about 15,000 catalogued specimens of fossil mammals, 6,000 fossil reptiles and amphibians and a few hundred fossil birds. Most of these are from the western United States. The collections of fossil horses, Eocene mammals and Cretaceous dinosaurs are unrivaled. The fossil rhinoceroses, camels, oreodonts, carnivora, Fayûm, Pampean and Patagonian mammals, Jurassic dinosaurs, Permian reptiles, turtles, etc., are likewise of the first rank. They include more than nine hundred type specimens of fossil mammals and several hundred type specimens of fossil reptiles and amphibians.

The Museum Library, located on the fifth floor, contains about 70,000 volumes on various branches of natural history (save botany), anthropology and travel. It is particularly strong in vertebrate palæontology and scientific periodicals. Like other museum libraries, it is of necessity a reference library, but, except on Sundays and holidays, may be freely used by the public during the hours when the Museum is open.

The publications of the Museum, aside from the *Annual Report*, fall naturally into two groups: scientific and popular. The former, comprising the *Memoirs*, *Anthropological Papers* and *Bulletin*, contain information gathered by the various expeditions, or derived from the study of material collected; they are from the nature of their subjects mainly of a technical character. The *Memoirs* consist of the larger, more important papers, or those that call for unusually large illustrations. These are issued from time to time as occasion may demand. The *Bulletin* comprises the shorter papers, those that contain information that it is desirable to issue promptly, and a volume of about 400 pages is issued annually. The scientific papers are distributed, largely in exchange, to museums and libraries throughout the world.

The popular publications include the *Journal*, *Leaflets*, *Guides* and *Handbooks*, and are intended for the information of the general public. The *Journal*, begun in 1900, is the means of promptly informing the Museum Members of the work of the institution, giving the results of the many expeditions, telling of the collections made, or more important information gathered. It also describes at length interesting or noteworthy installations, and notes the accessions to the various departments, changes in the personnel of the Museum, and elections to Membership. The *Illustrated Guide Leaflets* deal with exhibits of particular interest or importance, such as the Habitat Groups of Birds, the Evolution of the Horse, Meteorites, the Indians of Manhattan, calling attention to important objects on exhibition and giving information in regard to them. The *Handbooks*, the first of which, on the Indians of the Plains, was issued in 1912, deal with subjects or topics rather than objects. Thus the Plains Indians Handbook, by Dr. Wissler, is not merely a guide to the exhibition hall, but tells of the life and customs of these Indians, their language, political organization, religious beliefs and ceremonies.

The distribution of these popular publications is a part of the educational work of the Museum, as are the exhibits and lectures, and so far they have been necessarily sold below the cost of publication, as is done by other Museums. (*See list at end of this Guide.*)

An important part of the Museum, not seen by the public, is the work-
Workshops shops, located in the basement and provided with machinery of the most improved pattern. Here, among other things, are constructed the various types of cases used in the Museum, including the light, metal-frame case, devised in the institution.

Still other rooms, which, of necessity, are not open to the public, are the laboratories, wherein is carried on the varied work of preparing exhibits, work which calls for the services of a very considerable number of artists and artisans.

Here are cast, modeled, or mounted the figures for the many groups from Man to Myxine, here leaves are made to grow and flowers to bloom as accessories for beasts,* birds and fishes, to say nothing of reptiles and amphibians, and here, with painstaking care, are slowly created in glass and wax the magnified copies of invertebrates.

From all this it may be gathered that a museum is a very busy place, much more so than the casual visitor is apt to imagine. In fact, a very good museum man has said that a museum is much like an iceberg, seven-eighths of it under water and invisible. We will now proceed to the visible eighth.

*See Guide Leaflet No. 34.

Before entering the Museum one notices the "Bench Mark" established by the U. S. Geological Survey in 1911 on which is inscribed the latitude and longitude, $40^{\circ} 46' 47.17''$ N., $73^{\circ} 58' 41''$ W., and height above sea level, 86 feet.

On the right is a "pothole" from Russell, St. Lawrence Co., N. Y., formed by an eddy in the waters of a stream beneath the melting ice of the glacier that covered Northern New York. The stream carried pebbles that, whirled around by the eddy, cut and ground this hole, which is two feet across and four feet deep.

On the left is a large slab of fossiliferous limestone from Kelleys Island in Lake Erie near Sandusky, whose surface has been smoothed, grooved and scratched by the stones and sand in the bottom of the vast moving ice sheet or glacier that covered the northeastern part of North America during the Glacial Epoch. The front of this continental glacier is now thought by most geologists to have retreated northward across Lake Erie from 30,000 to 50,000 years ago. At Kelleys Island the ice was moving from east to west.

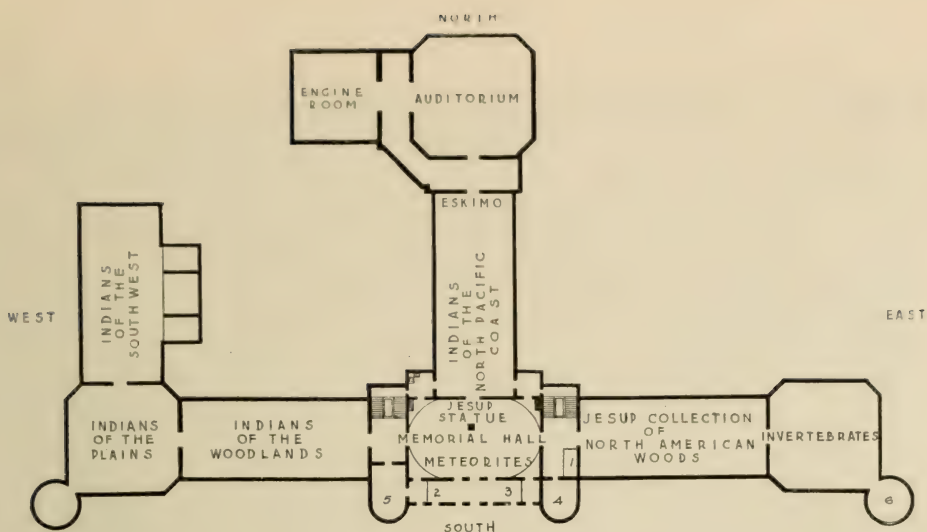


AT THE ENTRANCE TO THE MUSEUM



MEMORIAL STATUE OF MORRIS K. JESUP

Mr. Jesup, President of the American Museum of Natural History for more than a quarter of a century, was a staunch supporter of the institution's two aims, to be a great educational institution for the people and also a center for activity in scientific research



- | | |
|-----------------------|-------------------------|
| 1. Elevators | 4. Academy Room |
| 2. Information Bureau | 5. West Assembly Room |
| 3. Visitors' Room | 6. Collection of Corals |

FIRST FLOOR

SOUTH PAVILION

MEMORIAL HALL

The *Information Bureau* and the *Visitors' Room* are on either side of the south entrance. Wheel chairs for children or adults are available without charge. Postcards, photographs, guide leaflets, and Museum publications of various sorts are for sale, and visitors may arrange to meet friends here. On the right and left of the entrance are small *Assembly Halls* in which lectures to classes from the public schools of the City are given and where the New York Academy of Sciences and other scientific societies hold their meetings.

From the lobby the visitor first enters *Memorial Hall* and faces the marble statue of Morris K. Jesup; third President of the Museum. Mr. Jesup was a founder, trustee and benefactor of the Museum and for twenty-seven years its President. Under his administration and through his liberality the Museum made rapid progress. This statue of Mr. Jesup was executed by William Couper and was presented to the Museum by the Trustees and a few other friends. The marble busts in the wall niches represent noteworthy pioneers of American science, and are the gift of Morris K. Jesup. These include



THE VISITORS ROOM

Where they may rest, meet their friends, write notes or purchase publications and post cards

Benjamin Franklin, statesman and natural philosopher, Alexander von Humboldt, geographer and geologist, Louis Agassiz, zoölogist, Joseph Henry, physicist, John James Audubon, ornithologist, Spencer Fullerton Baird, zoölogist and founder of the United States Fish Commission, James Dwight Dana, geologist, John Torrey, botanist, Edward Drinker Cope, paleontologist, Joseph Leidy, anatomist, and Robert E. Peary, Explorer.

Memorial Hall was once the lecture hall and here thousands have listened to Professor Bickmore.

Circling this same hall is a portion of the collection of meteorites, popularly known as "shooting stars," ranging in weight from a few pounds to 36 tons. The greater number of meteorites are stony, but the more interesting ones are composed chiefly of iron, while certain meteorites contain both stone and iron. The toughness of iron meteorites is due to the presence of nickel, and the fact that they were so difficult to cut led to the adoption of an alloy of nickel and iron in making the armor plate for battleships. Meteorites have a very definite structure and when polished (see specimens on the right with electric lamp) show characteristic lines which together with their composition are to the expert absolute proof that the specimens are meteorites.

"Ahnighito" or "The Tent" at the left is the largest known meteorite in the world, and was brought from Cape York, Greenland, by Admiral R. E. Peary. It weighs 36 tons, and its transportation to New York was an engineering feat. Opposite it at the right is the curiously pitted "Willamette" meteorite from Oregon which was the subject of a famous lawsuit. The smaller meteorites will be found in the Hall of Geology, fourth floor. [The collection of meteorites is described in *Guide Leaflet* No. 26.]

Ahnighito
Meteorite

Willamette
Meteorite

SOUTH CENTRAL WING

INDIANS OF THE NORTH PACIFIC COAST

North of Memorial Hall, that is to the rear of the Jesus statue, is the *North Pacific Hall*, where are displayed collections illustrating the culture of the Indians of the Northwest Coast of America and also of the Eskimo. These collections are arranged geographically so that in passing from south to north through the hall the visitor meets the tribes in the same sequence that he would in traveling up the west coast of North America.

Indians of
British
Columbia and
Alaska



NORTH PACIFIC HALL AND THE CEREMONIAL HAIDA CANOE

This canoe, dug out from a single tree trunk, is 64½ feet long, large enough to contain forty people with their baggage. The figures represent in physique, dress and action various Indian tribes of the Alaskan coast one hundred years ago, those standing are a Chilkat Chief and his followers, the paddlers are slaves, captured from other tribes. The canoe was brought to the Museum from the Skeena River, Alaska, in 1883

The most striking object is the great Haida Canoe in the center of the hall. In it is being constructed a group representing a party of Chilkat Indians on the way to celebrate the rite of the "potlatch." The potlatch is the great "giving ceremony," common to all the coast tribes, when individuals and families gladly impoverish themselves that the dead may be honored, the emblem of the clan exalted and social standing recognized or increased. At the stern of the canoe, which is represented as approaching the beach, stands the chief or "medicineman," who directs the ceremony. The canoe is a huge dugout made from a single tree, is $64\frac{1}{2}$ feet long and 8 feet wide and capable of carrying 40 men.

Against the pillars and walls of the hall are many house posts and totem poles with their grotesque carvings; the latter may represent either the coat of arms or family tree, or they may illustrate some story or legend connected with the family. The Haida Indians together with the Tlingit are recognized as superior in art to the other Indian tribes along the northwest coast of North America. They are divided into a number of families with various crests for each family and grouped into two main divisions, the Ravens and the Eagles. The

Tlingit are makers of the famous Chilkat blankets, of which the Museum possesses an exceptionally fine collection.

Among some of the other tribes there is little wool weaving, the clothing consisting of shredded and softened inner tree bark braided and matted together. The Indians of this region are preëminently a wood-working people, as is manifest in the exhibit. Religious ceremonies and the wearing of masks generally supposed to aid the shaman or priest in curing disease were customary among most of the tribes. The masks represented guardian spirits and by wearing them the shaman impersonated these spirits.

The north end of the hall is devoted to Eskimo collections. The cases on the right show the manner of



Modern totem pole at Wrangel, Alaska. Many totem poles are huge cedar carvings so old that the Indians themselves have forgotten their meaning



CHILKAT BLANKET

dress, method of transportation, etc., also cooking utensils and bonework.

**Eskimo
Collections**

Notice to what extent the utensils, weapons and clothing are made from the skin or bone of the seal, walrus and other Arctic animals. The case marked "Eskimo Woman Cooking" shows a section of the interior of a snow hut or igloo lined with sealskin, the mother preparing the food in a primitive stone vessel, heated by flame from seal oil in the stone lamp below. The opposite case shows an Eskimo woman fishing through the ice. She has formed a windbreak with blocks of ice. The fish-rod and hook, and the long ladle are made of bone, and with this latter she keeps the water in the hole from freezing over while she is fishing. In this section will be found collections obtained by the Stefansson-Anderson expedition from the Eskimo of Coronation Gulf, some of whom had never seen a white man.

**Mural
Decorations**

The mural decorations of Arctic scenery are by Frank Wilbert Stokes; the mural decorations illustrating the industries and ceremonies of British Columbia and Alaska are by Will S. Taylor.

Auditorium

The doorway at the north end of the hall leads to the *Auditorium* which has a seating capacity of 1400, and is equipped with two screens, 25 feet square, for stereopticons. Free public lectures are given here Tuesday and Saturday evenings from October to May under the auspices of the Board of Education. There are also special



ESKIMO HOME SCENE

There are two instructive groups near the entrance to the Auditorium and underneath the Stokes Mural paintings of the Land of the Midnight Sun. In one, a home scene within a snow house or "igloo," an Eskimo woman is cooking blubber over the flame from a seal oil lamp, the other represents an Eskimo woman fishing through the ice. The Museum is rich in Eskimo collections

lectures for Members of the Museum as well as lectures for school children. At the entrance of the lecture hall is appropriately placed a bust of Professor Albert S. Bickmore, originator of the movement that resulted in the erection of the Museum, first curator, and founder of its lecture system.

In the adjoining corridor is a collection of the principal building stones of the United States, and specimens of petrified wood from the fossil forest of Arizona.

At the end of the corridor is the power room where may be seen demonstrated the transformation of the potential energy of coal into heat, light and motion.

Power Room

WEST CORRIDOR

To the right or west of the Jesup statue are three halls devoted to Indian collections. To reach these the visitor passes through the *West Corridor* which is devoted to the temporary display of recent acquisitions or small collections of particular interest. Here hangs a series of paintings of Mount Pelée, by the late Angelo Heilprin.

On the landing, at the head of the stairway is the William Demuth collection of pipes and fire-making appliances from many parts of the world.

SOUTHWEST WING

INDIANS OF THE WOODLANDS

The halls to the west contain collections from the North American Indians and together with the hall in the south central wing present the nine great culture areas of North America. (See maps on the south wall.) The hall you now enter represents chiefly the Indians in the Southeastern and Eastern Woodland areas, or all those formerly living east of the Mississippi River and south of the Great Lakes. They are, therefore, intimately connected with the early history of the colonies. In the eastern section of this hall, are the New York State Indians of whom the Iroquois are the most important because of their superiority in organization and power.

Indians of the
Woodlands



Carved birch bark kettle of the Penobscot Indians

The League of the Iroquois, or the Five Nations, comprised the Mohawk, Seneca, Oneida, Onondaga and Cayuga, later the Tuscarora, when it was styled the Six Nations. This league was formed probably as early as 1539 and with the purpose, as its founders boasted, of bringing peace and breaking up the spirit of perpetual warfare. The Oneida Indians were the only members of this league who, as a tribe, adhered to the colonists in the war of the Revolution.

Iroquois

In the wall case on the right are shown the dress, occupations and dwellings of the Iroquois. A life-size model of an Iroquois representing a messenger is holding out a belt of wampum. This wampum, made chiefly of the shells of the "quahog" or common hard clam of our markets, was utilized in various ways: it was greatly prized as an ornament and as trimming on garments; was an important feature

Wampum



IROQUOIS MASK *

in religious ceremonies and festivals, being the token by which the Indians kept records; and was the object by which public transactions were commemorated. Wampum was not used as currency, however by the Indians who had no standard of value until they found it in our currency, but it did come nearer currency than any other kind of property and when sold to white settlers the strings were counted and reckoned at half a cent a bead. The woman in the right of the case is pounding corn in a primitive mortar. The matrons of the Iroquois possessed

property of their own in distinction to that held by their husbands; they sat in council by themselves and had the right to terminate a war.

* The story of this particular false face, with its mouth twisted to one side, is as follows: When Haweniyu had made the earth, he wandered about over its surface contemplating his work. As he went along he met a False-face Being, who rudely demanded what Haweniyu was doing on his earth. The god indignantly replied that he had made the world. This the False-face Being denied, so after more discussion they decided upon a contest. They stood in the middle of a valley, and in order to show his power the False-face Being said, pointing to the mountains at one side, "Do you see those hills over there?" "Yes," replied Haweniyu. "Come here," said the Being to the hills, and immediately the hills came over and stood a few feet away. Haweniyu in his turn addressed not the cliffs but instead said to the False-face Being, "Turn around and see," and the False-face turned, and at the same time the god caused the hills on the other side of the valley to move up so swiftly and so close that they struck the False-face on the side of his countenance and twisted his mouth into the position it has held ever since. The Being then acknowledged the superior power of Haweniyu, and the god said that the False-faces might ever after live at the ends of the earth provided that they would not interfere with the children of men who were soon to be placed in the world. This the False-face Being agreed to with the promise that they would drive away witches and diseases and protect mankind.

On the left is a collection of grotesque masks. These were worn by the False Face Societies. The Indians were very superstitious and believed in the existence of demons or evil spirits who were without bodies, legs or arms, and possessing hideous faces only, were characterized as "false faces." There eventually grew up a society calling itself the "False Face Band" whose members were supposed to have power to counteract the evil done by these demons and to possess the capacity to heal sickness. Pictures by De Cost Smith illustrating the performances of this society are on exhibition in the cases.

The earliest Indians of the vicinity of New York City are represented by the archæological collections in the first alcove on the left. Here will be seen remnants of their crude pottery, weapons, cooking utensils, and various implements made of stone, wood or bone, collected chiefly from burial sites on Manhattan Island, Staten Island and Long Island. In one of the cases is a portion of an original dugout canoe which was excavated in Oliver Street in 1906 when a telephone conduit was being laid. This canoe and a large earthen pot are among the very few good specimens that have been found representative of New York City Indians.

Among the Delaware collections is a doll that was worshipped by this tribe as the guardian of health. Indians of the vicinity of New York City mostly belonged to this tribe.

In other parts of the hall, in approximate geographical order will be found typical exhibits from the Penobscot, Delaware, Shawnee, Potawatomi, Ojibwa, Menomini, Saukteaux, Eastern Cree, Winnebago, and Sauk and Fox of the Eastern Woodland Area, and the Seminole, Cherokee, and Yuchi of the Southeastern Area. In the south wall cases are small exhibits from the Mackenzie and Plateau culture areas for which a special hall will be provided in the future. The Seminole have never been entirely conquered. A part of them escaped deportation to Oklahoma and fled to Florida and have taken up their abode in the Everglades, hostile to the white men whom they will not allow to enter their domain. This exhibit is one of the three existing collections from the Seminole Indians.

Among the Menomini specimens there is an excellent collection of medicine bags, porcupine quill work and a buffalo skin headdress worn by the noted chief Oshkosh. The Menomini have always been friendly to the Americans.

The Ojibway and Menomini are typical Woodland Indians. They made maple sugar, gathered wild rice, worked in birch bark, and practiced a rather complex religion.

At the rear of the hall will be found collections from the Eastern Cree of James Bay and vicinity. While these people live in the woodlands and have a culture of that type, another division of the same people lives



Painted by George Catlin

AN OSAGE CHIEF AND TWO OF HIS WARRIORS

in the northern Plains and has a different culture, as may be observed by stepping inside the next hall.

In this, and the adjoining hall will be found many paintings by George Catlin, part of a series of four hundred, illustrating the life and ceremonies of the Indian of North and South America. They were presented to the museum by Ogden Mills.

[The Indians of Manhattan and vicinity are described in *Guide Leaflet* No. 29.]

SOUTHWEST PAVILION

INDIANS OF THE PLAINS

The collections from the Indians of the Plains will be found in the hall adjoining. These Indians comprised the tribes living west of the Mississippi and east of the Rocky Mountains as far south as the valley of the Rio Grande and as far north as the Saskatchewan. (See map on south wall.)

They include among others the Plains-Cree, Dakota, Crow and Blackfoot shown on the left of the hall, and the Mandan, Pawnee, Kiowa and Cheyenne on the right. Most of these

Indians of the
Plains

tribes were dependent on the buffalo, so much so that they have sometimes been called the "Buffalo Indians." Buffalo flesh was their chief



A BLACKFOOT TIPI, OBTAINED IN MONTANA, 1903

The interior shows the family life of a Blackfoot Indian. The man and women are engaged in household tasks, a tobacco board and pipe are in place for guests; on the family altar, just back of the fire, some incense may be seen burning as a religious rite. Tipis were originally made of buffalo hide, but this animal, having been practically exterminated, they are now made of duck or cotton cloth. This tipi was made about 1874 and used for more than a year by Heavy-runner, a noted Blackfoot Indian

food, and of buffalo skin they made their garments. In some cases a buffalo paunch was used for cooking and buffalo horns were made into various implements of industry and war. The spirit of the buffalo was considered a powerful ally and invoked to cure sickness, to ward off evil, and to give aid in the hunt. Whenever the buffalo herds led the way, the more nomadic Plains tribes moved their tents and followed. With the extermination of the buffalo the entire life of the Plains Indians was revolutionized.

In the center of this hall is a Blackfoot Indian tipi with paintings of otters on the sides, representing a vision of the owner. This tipi has been fitted up to show the home life of a typical Buffalo hunting Indian.

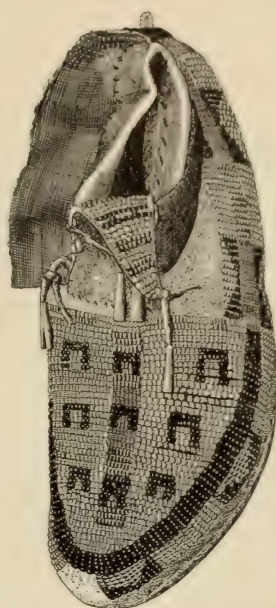
There were numerous soldier societies among the Plains Indians which included practically all the adult males.

Societies Each society had a special dance and special costumes. (See the Arapaho cases for costume dancers.)

There were other dances connected with tribal religious ceremonies, the best known and most important of which is the sun dance illustrated by a model at the left of the tipi. The sun dance was held annually in the early summer in fulfillment of a vow made during the preceding winter by some member of the tribe who wished a sick relative to recover. The dance involved great physical endurance and excruciating self-torture, lasting three days, during which time the dancers neither ate nor drank.

In the center of the hall is a genuine medicine pipe, held in awe by the Indians and dearly parted with; also the contents of a medicine pipe bundle. The contents of another medicine bundle, belonging to a leading man of the Blackfoot tribe (medicine man), together with the headdress which he wore in ceremonies, is in a case near the tower.

The Plains Indians are noted for their picture writing on skins and for their quillwork which has now been superseded by beadwork. They have a highly developed decorative art in which simple geometric designs are the elements of composition, this being one of the most interesting features of their art. (See Dakota case.) [See *Handbook* No. 1. North American Indians of the Plains.]



A beaded moccasin from the Indians of the Plains (Gros Ventre)

WEST WING

INDIANS OF THE SOUTHWEST

On the left are collections from the sedentary Indians who occupy the pueblos of the Rio Grande and of Hopi, Acoma and Pueblo Indians Zuñi; and also the objects recovered from the prehistoric pueblos, caves, and cliff-dwellings. On the right are the nomadic Indians — the eastern and western Apache, the Navajo, the Pima, the Papago, and several tribes of northern Mexico. In the south annex will be found baskets from the Indians of California.

The sedentary Indians live in large community houses often with several receding stories, built of stone or adobe. They depend chiefly upon agriculture for their food, make a great variety of pottery, and have many elaborate religious ceremonies. The nomadic peoples live in tipis or small brush and thatched houses which are moved or deserted when they are forced to seek the wild game and wild vegetable products which furnish much of their food. They make baskets for household purposes which are more easily transported than vessels of clay. There are models in the hall of the pueblos of Taos and Acoma, of prehistoric cliff-dwellings and of the houses used by the Navajo and Apache. In the first alcove on the left is shown the pottery of the villages along the Rio Grande, the principal art of the region, skin clothing, household utensils and ceremonial objects.

The upright cases of the next alcove are filled with wonderful prehistoric pottery. That in the wall case is from Pueblo Bonito. Similar gray and white ware with very elaborate and splendidly executed designs in an adjoining case are from Rio Tularosa, one of the upper tributaries of the Gila, where a vanished agricultural people once lived in pueblos and cliff-dwellings. A third case has pottery from the Casas Grandes of Chihuahua, Mexico, which represents the southern limit of the southwestern ancient culture. In the table case and in a case standing in the aisle are shown the wonderful art work in turquoise, shell, stone and wood of the former inhabitants of Chaco Cañon. These objects, as well as the pottery from Pueblo Bonito mentioned above, were secured by the Hyde Expedition.

In the next alcove, devoted to the Hopi, are the costumes, masks, images, and plaques used in their ceremonies. Besides the well-known snake dance, the various Hopi villages have many interesting ceremonies, many of which are concerned with the rainfall and their crops.

The inhabitants of Zuñi are believed to be the descendants of the first people seen by the Spanish in 1540. Their former villages, many of which are now in ruins, were probably the "Seven Cities of Cibola," for which Coronado was searching at that time. Although they had missionaries

among them for about three centuries, they have retained many of their own religious ceremonies. In the cases of the last alcove on the left are shown the woven costumes of Acoma and pottery from that pueblo. In the last case on this side of the hall are examples of Zuñi pottery, both ancient and modern.

The Pima, east side of the hall, practiced irrigation, raising by its aid the corn and beans on which they relied for food and the cotton which they used for their scanty garments. The Pima, with whom they are closely associated, occupied the more arid portions of southern Arizona and northern Sonora, securing their living from such desert products as the giant cactus, the century plant, the yucca and the mesquite and small game. Examples of their food, basketry, pottery, and ceremonial articles are shown.

The Navajo, a large and widely scattered tribe, inhabit much of the country drained by the San Juan and Little Colorado rivers. During the winter they occupy houses like the one standing in the large annex; but in milder weather, camp with the slight shelter of a cliff or a wind break and shade made of brush. They live by raising corn in the moist valley and on the flesh of their numerous flocks of sheep.

They are the present-day blanket makers of North America. They make use of the wool of the sheep they raise, carding, spinning, and weaving it by means of the simplest implements and looms. This art is believed to have arisen since the coming of the Spanish and it is known to have passed through several stages in the last sixty years. The older types of blanket here shown contain yarn which was obtained by cutting or ravelling from imported flannels called in Spanish, bayeta, from which the blankets of this sort receive their name. These are either bright red or old rose in color, resulting from cochineal dye. Several blankets are made of yarn bought ready dyed from the traders and are called Germantowns. The greater number, however, contain yarn of native spinning, dyed with native vegetable and mineral dyes.

The Navajo are also expert silversmiths. Their tools and samples of workmanship are displayed in a case in the center of the hall.

The Western Apache live in thatched houses, an example of which stands at the further end of the hall. They occupy the upper portion of the Gila and Salt rivers where they practice agriculture, gather the wild products and hunt. These were the people who, under Geronimo, raided the settlements of southern Arizona and Northern Mexico and evaded our troops for years.

The Eastern Apache lived in buffalo skin tipis. They went far out on the plains in search of the buffalo herds, avoiding, if possible, the plains tribes, but fighting them with vigor when necessary. In dress and outward life they resemble the plains Indians, but in their myths and ceremonies



An attractive Navajo blanket from the Museum's valuable collection. The Navajo Indians of the Southwest are a wealthy pastoral people, and the best Indian blanket makers of North America

they are like their southwestern relatives and neighbors. The baskets of the Apache are shown in the large end case which is in contrast with the corresponding case on the other side of the hall. Not the environment but social habits caused one people to develop pottery and the other to make the easily transported and not easily breakable baskets. [See *Handbook*, Indians of the Southwest.]

[Return to the *Jesup Statue*.]

EAST CORRIDOR

POLAR MAPS

Leaving the statue on the left and "Willamette" meteorite on the right and going east the visitor enters the corridor where the elevators are located (*East Corridor*). Here will be found maps of the north and

south polar regions showing the routes of explorers. On the wall by the north polar map are the sledges used by Admiral Peary in his last three expeditions in search of the North Pole. The Morris K. Jesup sledge which the Admiral used in his successful polar expedition is the one nearest the entrance. The various sledges in their differences of style show the persistent effort made by Admiral Peary to bring the sledge up to its greatest possible usefulness. That he was successful on his last trip was in part due to the final modification.

On the opposite side of the doorway is one of the sledges used by Amundsen on his journey to the South Pole. [A history of south polar expeditions is given in *Guide Leaflet* No. 31.]

In a room at the north end of this corridor is the large Mainka seismograph, for recording the occurrence of earthquakes. This was given to the New York Academy of Sciences by Emerson McMillin, and by the Academy deposited in the Museum.

SOUTHEAST WING

JESUP COLLECTION OF NORTH AMERICAN WOODS

To the east of the elevators is the *Hall of North American Forestry* containing the Jesup Collection of North American Woods, a nearly complete collection of the native trees north of Mexico, presented to the Museum by Morris K. Jesup. On the right

is a bronze tablet, by J. E. Fraser, the gift of J. J. Clancy, depicting Mr. Jesup as he walked in his favorite wood at Lenox, Mass.

To the left is a section of one of the Big Trees of California, sixteen feet in diameter and 1341 years old. It began its growth in the year 550, so that it was nearly a thousand years old before America was even dis-



WILD PLUM IN THE FORESTRY HALL

Each of the five hundred species of trees in North America is represented by a section of trunk five feet long, some of a diameter not found in the country's forests to-day. Many of the specimens are accompanied by wax models of leaves, flowers and fruits accurately reproduced from life

covered. The specimens show cross, longitudinal and oblique sections of the wood finished and unfinished, and the labels on the specimens give the distribution of the species, the characteristics of the wood and its economic uses. The trees are grouped by families and the location of each family will be found on the floor plan at the entrance of the hall. The reproductions of the flowers, leaves and fruits in natural size are instructive. This work is done in the Museum laboratories. Note the character of forests as shown by the transparencies. [For fuller information in regard to this hall see *Guide Leaflet* No. 32.]

SOUTHEAST PAVILION

INVERTEBRATES

At the extreme east is the *Darwin Hall*, devoted chiefly to the invertebrate animals (those which do not possess a backbone) and to groups illustrating biological principles. Facing the entrance is a bronze bust of

Synoptic Series

Darwin by Wm. Couper presented by the New York Academy of Sciences on the occasion of the Darwin centenary in 1909.

Passing around the hall from left to right, the progression is from the lowest forms of animal life, the one-celled Protozoa, to the highest

and most complex forms of animal life, the Primates, including man. The distinctive characteristics of each group are fully described on the alcove and case labels. Many of the minute forms are represented by skilfully prepared models in glass and wax showing the animal many times enlarged. Thus the visitor may obtain an idea of the form and structure of these animals



European commercial sponge comparable with the Florida yellow sponge or "Hardhead." The sponge industry in both the Mediterranean and the Bahama region is almost destroyed by careless methods, and conservation must be practiced here as in other of the world's resources

which in spite of their small size have in so many instances such a vital influence on the life of man.



A PART OF THE WHARF PILE GROUP



Marine Habitat Group. A community of starfishes, sea anemones, sea urchins, corals and sponges as seen below the edge of a coral reef in the Bahamas

This alcove contains the lowest forms of animal life. All are single-celled individuals. The simplest kinds are abundant in swamps and stagnant water, others are found in myriads in the sea while the ocean bottom in many localities is covered with them. The specimens exhibited in this alcove are mainly models, some of which are enlarged more than a thousand diameters.

Alcove 1
Protozoa

Sponges are principally of two kinds — those with skeletons or supporting structures of silica (i. e. flint) and those with skeletons of horn. The sponges of commerce belong to the latter class. In the specimens exhibited the skeleton only can be seen, the living tissue having been removed. Many of the “glass” sponges are very beautiful in design. Sponges range in size from the tiny *Grantia* of the New England coast to the gigantic “Neptune’s goblets” found in the eastern seas. This alcove contains certain specimens whose tissue is represented in wax tinted to show the natural coloring of sponges, which varies from the bleached yellowish color commonly seen to deep brown or black, or yellow and red, in varying shades.

Alcove 2
Sponges

In Alcove 3 are shown coral animals and their relatives: plant-like hydroids which often are mistaken for sea moss, but which really are a series of polyps living in a colony; jellyfishes with their umbrella-shaped bodies and long streaming tentacles; brilliant colored sea anemones, sea fans and sea plumes; the magenta colored organ-pipe coral, the stony corals, and the precious coral of commerce. Coral polyps mistakenly called "coral insects" are the animals that build up the coral reefs. In front of the window is a life-sized model in glass of the beautiful Portuguese Man-of-War. This organism is really a colony of many polyp individuals attached to one another, and specialized for various functions.

The best known species in this group is the tapeworm, whose development and structure are accurately shown by the models in the central case. As will be seen, its structure is more complex than that of preceding forms.

These are for the most part parasitic, living in the digestive canals of mammals. The most familiar is the common roundworm or intestine worm, *Ascaris*, an enlarged model of which is exhibited.

The minute wheel animalcules comprise many exquisite and grotesque forms, some of which construct tubes of gelatinous substance, sand-grains, etc. A few of the species are parasites, but most of them live a free, active life. They are aquatic and mainly found in fresh water.

The sea-mats in Alcove 7 are plant-like animals which lead the colonial form of life. The majority of the species are marine, although a few occur in fresh water. The lamp shells shown in this alcove superficially resemble clams, but by structure are more closely related to the worms and starfishes.

Alcove 8 is occupied by the starfishes, the sea urchins, sea cucumbers and sea lilies. The starfish is the pest of the oyster beds where it feeds on oysters and destroys them in large numbers. The brittle stars when handled or attacked are able to drop off an arm and later regenerate another. Sea urchins are an important article of food in Europe and the West Indies.

The annelids, typified by the familiar earthworm, are worms whose bodies are made up of rings or segments. They are inhabitants of both fresh and salt water, many kinds living in the mud and sand of the shore while others bore into wood and shells. The "houses" that these annelids build are often very beautiful and interesting. In the window is a group showing a section of a mud flat on the New England coast with the variety of worm life found in what to the casual observer seems to be an uninhabited area.

Arthropods include the familiar crabs, lobsters, insects and their relatives. The number of existing species in this group is greater than that of all the rest of the animal and vegetable kingdoms together. No other group comprises so many species useful or harmful to man. In the case in the center of the alcove is a model showing the anatomy of the common lobster, also enlarged models showing heads of various species of insects. On the wall are two of the largest specimens of lobsters that have ever been taken. They weighed when alive thirty-one and thirty-four pounds respectively. The largest of the arthropods is the giant crab of Japan, some of which, like that placed on the wall, have a spread of about ten feet.

The mollusks form a group second only to the arthropods in the vast number and diversity of forms which it embraces, including marine, fresh water and land animals. All mollusks have soft bodies but nearly all of them secrete a shell which in many species is of pearly material (mother-of-pearl). Well-known examples of this group are the common clam and oyster and enlarged models in the center case show the anatomy of these species. The largest species is the huge "bear's paw" or furbelowed clam of the eastern seas.

Vertebrates include the largest, most powerful and most intelligent of animals. This group culminates in man who still bears witness to his chordate ancestry in the retention of a chorda (cartilaginous spine), and gill clefts during embryonic life. Among these ancestral forms are the Ascidians, or Sea-squirts, an enlarged model of which is shown in the central case, while others are shown among the animals on the wharf-piles in the window group. The models in the central case show the development of the egg of typical vertebrates.

An exceptionally large specimen of beautiful madreporine coral is in the case near the entrance, and the associations of marine life that may be found among the coral reefs of the Bahamas are represented by several small groups in the center of the hall. Certain of the groups in this section of the hall illustrate various biological principles associated with the name of Darwin. The variation in form, size and color of the snail and the variation of the shell of the common scallop are graphically shown.

Four large models in the center of the hall show the mosquito which is the agent in the spread of malaria. These models represent the insect enlarged seventy-five diameters or in volume four hundred thousand times the natural size. The mosquito in its development undergoes a metamorphosis. The model at the left shows the aquatic larval stage; the larvæ are the "wigglers" of our rain water barrels. The next model is the pupal stage, also



A PORTION OF THE BULLFROG GROUP

Two frogs are engrossed in a chickadee on the birch branch above. The smaller frog seems likely to fall a prey to a black snake ready to strike from the white azalea near.

The scene is typical of Southern New England in July. The frogs and the reptiles are wax casts from life. The various activities of bullfrog life are set forth, with their relation to birds and small mammals, fish, snakes, turtles, insects and snails. The metamorphosis from the tadpole is also shown

aquatic. The third model is of the adult male mosquito which is harmless since it never bites man. The fourth model shows the adult female mosquito in the attitude of biting. In another case is a series of models showing the life cycle of the malarial germ in the blood of man and in the mosquito.

In several of the alcove windows are habitat groups of invertebrates illustrating the natural history of the commoner and more typical animals.

Window Groups In the Annulate Alcove is shown the Marine Worm Group reproducing these animals with their associates in their natural surroundings, as seen in the harbor of Woods Hole, Mass. The harbor and the distant view of Woods Hole village with the U. S. Fish Commission buildings are shown in the background, represented by an enlarged colored

Marine Worm Group photographic transparency. In the foreground the shallow water of the harbor near the shore is represented in section to expose the animal life found on muddy bottoms among the eel-grass, as well as the chimneys of various worm-burrows. In the lower part of the group a section of the sea bottom exposes the worms within the burrows. Several species of these are represented. [*See Reprint.*]

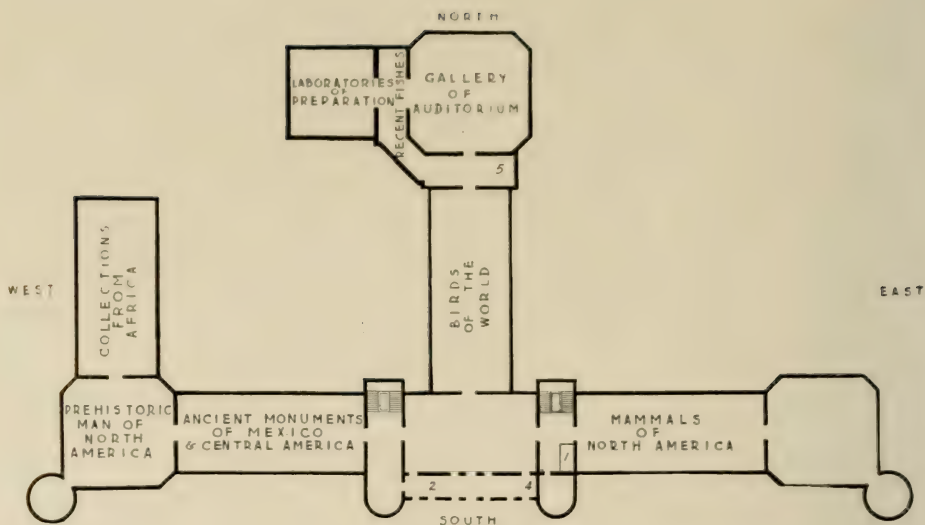
In the Mollusk Alcove window is shown the natural history of a sand-spit at Cold Spring Harbor, Long Island, including some of the shore mollusks and their associates. The entrance of the harbor is seen in the distance. In the foreground at the edge of the sand-spit a mussel-bed is exposed by the receding tide over which fiddler-crabs are swarming into their burrows. Beneath the water surface an oyster is being attacked by a star-fish, while crabs and mollusks of various species are pursuing their usual activities.

Shore Mollusk Group The window group in the Vertebrate Alcove shows the piles of an old wharf at Vineyard Haven, Mass. Below the low-tide mark the submerged piles are covered with flower-like colonies of invertebrate animals. Among these are sea-anemones, tube building worms, hydroids, mussels, sea mats and several kind of ascidians or sea-squirts. The latter are primitive members of the Chordate group which includes the vertebrates. Like the embryo of man, they possess during their larval period a chorda or cartilaginous spine. At first they are free swimming but later in life many of their organs degenerate and they become fitted to a stationary mode of life. [*See Reprint.*]

Wharf Pile Group Other exhibits illustrate certain facts made clear by Darwin. On the right and left of the entrance variation under domestication is illustrated by dogs, pigeons, and domesticated fowls, the wild species from which they have been derived being shown in company with some of the more striking breeds derived from them.

Variation under Domestication The struggle for existence is portrayed by the meadow mouse, surrounded by its many enemies and yet continuing to maintain an existence by virtue of its great birth rate.

Struggle for Existence [*Return to the elevators.*]



1. Elevators

SECOND FLOOR

SOUTH PAVILION

This hall illustrates a phase of Museum progress, the temporary disorder that precedes an ultimate change for the better. At present the hall contains a mixed assemblage of animals brought hither from other halls in process of re-arrangement; later it is hoped that it will contain a series of groups of birds from various parts of the world.

The Asiatic elephant is the famous "Tip" brought to this country in 1881, and for seven years one of the attractions of Forepaugh's circus. He was given to the City of New York by Mr. Forepaugh and lived in the Central Park Menagerie until 1894, when because of his treacherous disposition it was found necessary to kill him. He is said to have caused the death of several of his keepers, and was twenty-three years old when killed.

Here, awaiting the construction of a new wing is exhibited the collection of reptiles and amphibians. Because of the difficulty of preserving the natural covering of many of these animals they are usually exhibited in jars of alcohol. In the specimens on exhibition here, the perishable parts have been cast in wax from

life; for example in the star tortoise the original "shells" of the specimens are used, while the head, neck and legs are restored in wax. The mounting not only brings out the principal features of the species exhibited, but in many instances illustrates also some distinctive habit of the animals; for instance the common newt, one of the salamanders, is represented by a series of five life-size casts showing the process of shedding the skin; Pickering's hyla or the "spring peeper" is shown with vocal sacs inflated; the poisonous bushmaster is represented with its eggs, and so on.

The classification of these animals is shown in the upright cases; the groups in the center of the hall represent various reptiles as they appear in their natural haunts. They include the tuberculated iguana, the water moccasin, the diamond-backed rattlesnake, the Texas rattlesnake, the copperhead, the Gila monster, the pine snake, the box tortoise and the common painted turtle.

One of the most interesting of the groups is a jungle scene in India showing a water monitor, which is the largest of living lizards, the poisonous Russell's viper and the deadly spectacled cobra, the last with hood distended and body poised ready to strike. The cobra is said to be the cause of a large proportion of the 20,000 deaths which annually occur in India from snake bite. Examine carefully the group of the copperhead snake or "red-eye," one of the two species of poisonous snakes to be found in the vicinity of New York and also the group contrasting the harmless water snake with the poisonous water moccasin of southern cypress swamps. Two groups are devoted to rattlesnakes, which are easily recognized by the string of rattles at the end of the tail, by means of which they give warning before they strike. There are comparatively few species of poisonous snakes in the United States, about sixteen in all, comprising rattlesnakes, the moccasin, copperhead and two kinds of coral snake. All other species are harmless and in spite of the almost universal prejudice against them, are a very useful ally of man since they live chiefly on rats, mice and insects injurious to crops.

Entering the darkened gallery nearby, we find a series of four large groups which show what can be done in reproducing reptiles and amphibians in wax, making them seem alive and in action. The groups reproduce accurately also the natural haunts of the animals and with a beauty of composition, color and lighting which gives them decided art value. As to educational value, the reptile groups give to the children of New York City (nearly a million in number) opportunities which they might not otherwise have to see "the country," to get acquainted with animals in which they are always peculiarly interested, and to learn more about them in a half hour's observation than they could discover in years of study in the field — thus forming the basis for both interest and trained observation when opportunity for rural life may come to them later.



LOWER CALIFORNIA LIZARD GROUP

Showing the characteristic animal and plant life of one of the small desert islands off the coast of Lower California. The material for this group was collected by the "Albatross" Expedition of 1912 under Dr. C. H. Townsend

The giant salamander or hellbender best known in the streams of western Pennsylvania has its breeding season in autumn. [The scene shows blue asters and ripening grapes along the river.]

Giant Salamander Group Note that the hellbenders are wholly aquatic, no one of them being shown even partially out of water. The river is represented as flowing directly toward the observer to expose the nests and eggs which are under the rocks on the down stream side out of the current. At each nest a salamander (the male) is on guard over the eggs, and there are young salamanders one year old and two years old. Also various habits of the salamanders are shown, for instance, one is molting its skin, and others are eating crayfish caught from the rocks, or small fish. The animals of the giant salamander group are cast from the salamanders themselves, soft, jelly-like animals when taken out of water and which therefore had to be posed under oil so that their natural form would be kept while the plaster molds were being made.

The scene is a typical lily pond and this giant of North American amphibians is shown living both under the water and above on the land.

Bullfrog Group The group illustrates the changes from the tadpole to the adult frog and shows many of the activities of the frog — its molting, swimming, breathing under water and in air, croaking and “lying low” before an enemy; also food habits in relation to small mammals, to birds, snakes, insects, small fish and turtles. The plant life of the group affords study of ecological arrangement from the delicate under-water forms, through the floating duckweed and near-shore water lilies and pickerel weeds to water-loving shrubs such as willow, swamp alder and white azalea. The group has a transparent background, the lights in front balanced by other lights behind the painted canvas.

The lizard group pictures a Lower California island. The brilliant hot sunshine, the sand, cacti and volcanic rock with the various kinds of lizards fitted to endure desert life make a striking contrast with adjoining groups. The larger specimens of the group, the iguanas and chuckwallas as well as the horned toads are mounted skins. The smaller specimens, such as the zebra-tails (at the center of the group) and collared lizards (running at rear left), are wax casts. The group had an interesting method of construction. All the ground work, the rocky slopes enclosing sandy gulleys leading down to the sea, was modeled life size in clay and then cast as a whole in plaster, so that the completion of the group meant merely the addition of plants and animals as planned and the final perfecting of all with color, papier-mâché and wax.

The toad group might well be given some more descriptive name. It presents a New England scene in early May and seems the personification of spring, filled with the exuberance of new life and suggesting everywhere motion and sound. Birds are just at the

Toad Group

moment of flitting; toads and "tree toads" are calling, their resonating throat pouches looking like great bubbles. The colors of May are soft yet brilliant in the new leaves of oak and maple, hornbeam, shadbush and tall blueberry, and everywhere can be seen the gleam of water drops from a recent rainfall. Stand far back at the extreme right and observe the group; also at the left, and note how the foreground leads into and is carried on by the background. It is as though we could walk far into the woods that stretch before us shining in the sun. The group shows the following species together with eggs and larvæ as they are in early May: two species of toads, the American at the left and Fowler's at the right; three kinds of frogs, the spotted pickerel frogs, the green frogs and the little brown wood frogs; two kinds of tree frogs, the spring peeper at the left, the common "tree toad" at the right; two of salamanders, spotted amblystomas and American newts, besides some snakes and turtles common at this season. Two of the most frequent questions asked by those who visit the country and are interested in its small animal life are "What is the difference between a toad and a frog?" and "How can I tell frog's eggs from toad's eggs and from salamander's eggs?" These questions are answered definitely by the group, which is the first attempt to reproduce in permanent form the gelatinous egg masses and developing tadpoles at different stages. The plant life is typical of early May in New England. A wild apple tree is in blossom over a tumble-down stone wall. Wild flowers are so perfectly made that although set close before the eyes of the observer and in the most brilliant light, yet it is difficult to see that they are not real — yellow marsh marigolds, blue violets, Jack-in-the-pulpits, white anemones, star flowers and trilliums and red columbines. The group emphasizes in its fine detailed technique the expert character of the Museum's artists working in wax and glass.



THE AMERICAN ROBIN — ONE OF THE GROUPS OF LOCAL BIRDS

WEST CORRIDOR

LOCAL BIRDS

Adjoining the *South Pavilion* is the *West Corridor* which contains the collections of local birds.

In this room are specimens of all the varieties of birds which have been known to occur within fifty miles of New York City. As far as possible each species is shown in all its different plumages. In the wall cases nearest the entrance on both sides is the *General Collection* of all birds likely to be seen within this area, arranged according to the current American system of classification. Near the windows are cases containing the *Seasonal Collection*, one section containing the permanent residents while others have their contents changed each month so that they may show always the birds present at the time. In another section are the stragglers from other parts of the country and from other countries which have been taken within our limits.

Besides the table case containing the eggs (often with the nest) of species known to nest within fifty miles of the City and the collection of



HALL OF MEXICAN AND CENTRAL AMERICAN ARCHAEOLOGY

A collection comprising many casts of ancient stelae, or monuments carved from volcanic stone, and probably commemorating events in pre-Columbian times; also codices or chartlike books that later replaced the stelae as records; casts of sacrificial stones; pottery and figures worked in clay; and many objects in jade, gold, and copper

photographs showing many of them in nature, there are down the middle of the room a series of groups of local breeding birds with their nests. These the forerunners of our "Habitat Groups," were the first of their kind made for the Museum. [See *Guide Leaflet* No. 22.]

SOUTHWEST WING

ANCIENT MONUMENTS OF MEXICO AND CENTRAL AMERICA

Continuing west, past the collection of local birds we enter the *Southwest Wing*, devoted to ancient monuments of Mexico and Central America. The reproductions illustrate chiefly the sculptures of the Maya and Nahua Indians made before the time of Columbus and are the gift of the Duke of Loubat.

At the left of the entrance are cases of pottery, jade and heavy stone work from Panama, Costa Rica and Nicaragua. For skill in free hand modeling and painting the pottery ranks high.

Opposite this exhibit are examples of original stone sculptures of the
Maya Art Maya, mostly excavated at Copan in western Honduras.

Beautiful pottery and finely wrought jades are also shown from other sites. The Maya were perhaps the most highly civilized people in the New World. They built many cities of stone and erected many fine pillar-like sculptures which are called stelæ. The subject-matter on these monuments deals with priest-like beings who carry serpents and other ceremonial objects in their hands. There are also long hieroglyphic inscriptions containing dates in the wonderful Maya calendar. Maya history contains two brilliant periods. That of the south, extending from 160 A.D. to 600 A.D., was chiefly remarkable for its sculptures. The principal cities were Copan, Quirigua, Tikal, Yaxchilan and Palenque. The second period fell between 950 A.D., and 1250 A.D., and centered in northern Yucatan. The chief cities were Chichen Itza, Uxmal and Labna, and the finest works of art were architectural.

Passing to the end of the hall and then returning toward the east en-
Copan trance, we see, on either side of the aisle, reproductions of the stelæ and altars of Copan arranged in order from the oldest and crudest forms to the latest and finest examples of carving, covering a stretch of nearly 300 years. The early stelæ have hieroglyphs carved in very low relief and with sharp corners, while the hieroglyphs on the later monuments are cut deeper and in more rounded relief. In the early stelæ human figures are carved in an awkward block-like manner, with protruding eyes and angular limbs. The two lofty stelæ in the center are from Quirigua and date from about 550 A.D. From this city also comes



THE AZTEC GODDESS OF THE EARTH

The famous statue of the Aztec Goddess of the Earth called *Coatlicue*, "the Serpent-skirted One," is a striking example of barbaric imagination. It was found in Mexico City near the Cathedral in the year 1791. It doubtless occupied an important place in the great ceremonial center of Tenochtitlan, the Aztec capital, and probably dates from the last quarter of the 15th century.

The head, which is the same on front and back, is formed by two repulsive serpent heads meeting face to face. The feet are furnished with claws, but the arms, which are doubled up with the elbows close to the sides, end each in a serpent's head. The skirt is a writhing mass of braided rattlesnakes. The creature wears about the neck and hanging down over the breast a necklace of human hands and hearts with a death's head pendant in the center. Coatlicue seems to have been regarded as a very old woman and as the mother of the Aztec gods.

the elaborately sculptured boulder that may have served as an altar. It represents a two-headed monster overlaid with several layers of ornament. Sculpture from Palenque and other cities is also shown.

The second or architectural period of Maya art is exemplified in the copy of the painted sculptures of the Temple of the Jaguars at Chichen Itza. Here are shown warriors in procession who seem to be coming to worship a serpent god. Prayers are represented as coming from their lips. This sculpture shows strong evidence of Mexican influence in certain of its details.

Next in order is the Nahua culture represented in the alcove cases by ancient pottery, musical instruments, copper objects and ornaments of obsidian and jade. One case contains facsimile reproductions of native books, or codices, which were painted free hand on strips of deerskin, paper or cloth. Several original documents are also exhibited. The Spaniards, in their zeal to destroy the native religion, burned hundreds of these books which recorded ceremonial rites and historical events by means of pictures and hieroglyphs. The Nahua culture extended through many centuries leaving remains, such as pottery, which are found deposited in distinct layers, one above the other. In the valley of Mexico there are three so-called culture horizons, the last being that of the Aztecs. There is no good reason to believe that any connection in art or religion existed between Mexico and any part of the Old World.

The Aztecs founded their capital city, called Tenochtitlan (Mexico City), in the year 1325, and had a short but brilliant history.

Before the arrival of Cortez, in 1519, they had reduced most of the provinces of central Mexico. The sacrificial stone, or Stone of Tizoc, is a record of some of their principal conquests made before 1487. The Calendar Stone is a graphic representation of the four prehistoric creations and destructions of the world as well as symbol of the sun and a record of the divisions of the year. The statue of Coatlicue, the mother of the two principal Aztec gods, is a curious figure, made up of serpents.

All three sculptures were originally in the Great Temple enclosure and are now in the Mexican National Museum.

The funeral urns of this region are highly conventionalized figures. A cruciform tomb at Guiaroo, near the ruins of Mitla, is shown by a model at this end of the room.



THE HEAD OF THE AZTEC EARTH GODDESS

Head of a rattlesnake, rattlesnake as shown in Aztec carvings, outline of head of Earth Goddess. In the real snake the fangs do not show unless the mouth is open. In the Aztec figure two fangs are shown, one of these being a reserve fang that comes forward to take the place of the fang in use should that be lost

SOUTHWEST PAVILION

PREHISTORIC MAN OF NORTH AMERICA

Continuing west we pass into the *Southwest Pavilion* likewise given over to archæology, in this instance that of North America. Here are examples of ancient pottery, arrow-heads, stone axes and other implements of stone and bone, mostly from burial mounds. The most important of these are the rude implements and fragments of human bones from the Trenton gravels, as these are the oldest indubitable evidences of man on this continent. Notice that the arrangement of the hall is geographical and by states. In addition there is a special exhibit of Mississippi Valley pottery in the wall cases and the Douglass type specimen series in the cases to the left near the center.

In the tower room adjoining are the stone implements and rude carvings of the primitive men who inhabited the caves of Southern Europe at a time when England was a peninsula, the north of Europe buried deep under the ice of a glacial epoch and the reindeer and the hairy mammoth roamed through Southern France.

Around the room are copies of paintings — for primitive man was an artist as well as a hunter — on the walls of the caves of Altamira, Font de Gaume, and others, showing the bison, wrongly called aurochs, the mammoth and the horse of that day, the contemporaries of the *Neanderthal* man.

In the table cases are selected series of stone and bone implements arranged according to the accepted chronological periods of paleolithic times. In an adjoining case may be seen casts of the Heidelberg jaw and other ancient skeletal remains.



WEST WING

COLLECTIONS FROM AFRICA

Opening to the north from this hall of North American Archæology is the African Hall. This differs from other halls in containing besides ethnographical specimens a number of characteristic African mammals. The future extension of the Museum will provide room for groups of African mammals, including elephants. The installation is geographical, i. e., as the visitor proceeds through the hall from south to north he meets the tribes that would be found in passing from south to north in Africa, and the west coast is represented along the west wall, the east coast along the east wall.

There are three aboriginal races in Africa: the Bushmen, the Hottentot, and the Negroes. In the north the Negroes have been greatly influenced by Hamitic and Semitic immigrants and become mixed with them.

At the south end of the Hall the wall is decorated with reproductions of cave-paintings made by the Bushmen, the most ancient and primitive of African natives. These works of art are remarkable for their realism, and should be compared with the reproductions of old European cave paintings in the tower of the adjoining hall.

Nothing is more characteristic of the Negro culture, to which the rest of the Hall is devoted, than the art of smelting iron and fashioning iron tools. The process used by the African blacksmith is illustrated in a group near the entrance, on the west side, and the finished products, such as knives, axes, and spears, are amply shown throughout the hall. The knowledge of the iron technique distinguishes the Negro culturally from the American Indian, the Oceanian, and the Australian.

All the Negroes cultivate the soil, the women doing the actual tilling, while the men are hunters and, among pastoral tribes, herders. Clothing is either of skin, bark cloth, or loom-woven plant fiber. The manufacture

of a skin cloak is illustrated by one of the figures in the group to the left of the entrance; bark cloths from Uganda are shown in the northeastern section of the Hall; while looms and the completed garments are shown in the large central rectangle devoted to Congo ethnology. The most beautiful of the last-mentioned products are the "pile cloths" of the Bakuba, woven by the men and supplied with decorative patterns by the women. Very fine wooden goblets and other carvings bear witness to the high artistic sense of the African natives, who also excel other primitive races in their love of music, which is shown by the variety of their musical instruments.

A unique art is illustrated in the Benin case in the northwestern section of the Hall, where the visitor will see bronze and brass castings made by a process similar to that used in Europe in the Renaissance period. It is doubtful to what extent the art may be considered native.

The religious beliefs of the natives are illustrated by numerous fetiches and charms, believed to give security in battle or to avert evils. Ceremonial masks are shown, which were worn by the native medicinemen.

[Return to Central Pavilion.]

SOUTH CENTRAL WING

BIRDS OF THE WORLD

Going north we enter the hall containing the general collection of birds. In the first four main cases on the right the 13,000 known species are represented by typical examples of the principal groups arranged according to what is believed to be their natural relationships. The series begins with the Ostriches, the "lowest" birds (that is, those which seem to have changed least from their reptilian ancestors) and goes up to those which show the highest type of development, the Singing Perching Birds such as our Thrushes and Finches. The remaining cases on the right wall and all of those on the left show the geographical distribution of the bird fauna of the world. The specimens are grouped according to their great faunal regions, the South American Temperate, American Tropical, North American Temperate, Arctic Eurasian, Indo-Malay, African and Australian realms. These cases in connection with the accompanying maps give opportunity for a comparative study of the birds of the different parts of the world. In each region, as in the Synoptic Collection, the birds are arranged in their natural groups to the best of our present knowledge.

Down the middle of the hall near the entrance are several cases containing birds which have become extinct or nearly so. The Labrador Duck, once a common visitor to our Long Island shores, became extinct for no known reason. The Great Auk and the



THE PTARMIGAN IN WINTER

One of a series of four small groups showing this bird's seasonal changes of color as brought about by molting and feather growth

Dodo were flightless species which bred in great numbers on small islands and were easily and quickly killed off by men. The Passenger Pigeon of North America lived by the million in such dense flocks that vast numbers were slaughtered with ease, so that now (1914) the *only individual left alive* is an aged female in the Cincinnati Zoölogical Gardens.* The Heath Hen formerly had a good range on our Atlantic seaboard, but as a game bird, it was so continually persecuted, in and out of the breeding season, that it is now extinct except for a few which survive under protection on the island of Martha's Vineyard. Others of our splendid game birds, such as the Trumpeter Swan and Eskimo Curlew, are nearly, if not quite gone, and more like the Wood Duck and Wild Turkey, will soon follow them if a reasonable close season and limited bag be not rigidly enforced. Still others — the beautiful Egrets and the Grebes, for example — have already gone far on the same road owing to the great demand for their plumage for millinery purposes.

The widely different plumages (varying with age, sex, season, or all three) often worn by one species will be found illustrated in the Ptarmigan case and in the case containing Orchard Orioles, Snow Buntings, Scarlet Tanagers and Bobolinks. The relation-

General Topics

* Died September 1, 1914.



LABRADOR DUCKS, NOW EXTINCT
From the Group in the American Museum

ship between structure and habits, the many forms of bill, feet, wings, tail, etc., and the different ways of using them are illustrated in other cases, particularly by one showing the feeding habits of some birds.

In the alcoves to the right the first egg case contains the Synoptic Collection of Eggs which shows the variation in the number Eggs in a set, size, shell texture, markings, shape, etc., and tells something of the laws governing these things. The succeeding cases contain the general exhibition collection of nests and eggs, principally those of North American and of European birds.

At the north end of the hall is a nearly complete collection of the Birds of Paradise, presented by Mrs. Frank K. Sturgis. This family of birds is confined to New Guinea, Australia and some neighboring islands. Their feet and bills show their close relationship to the Crows and Jays, which they resemble in nesting habits as well. Their chief characteristic is of course their gorgeous plumes, wonderful as well in variety of form and position as in beauty. For these plumes the birds are still being killed in such large numbers that unless the demand for them soon ceases all the finer species will be exterminated, as the Great Bird of Paradise is believed to be already. More Birds of Paradise have been sold at a single London auction (23,000 in two sales) than are contained in all the museums of the world.

Also in this hall are a number of groups of local and other birds which are placed here only temporarily. In fact, much of the arrangement of the hall will be changed as soon as circumstances permit.

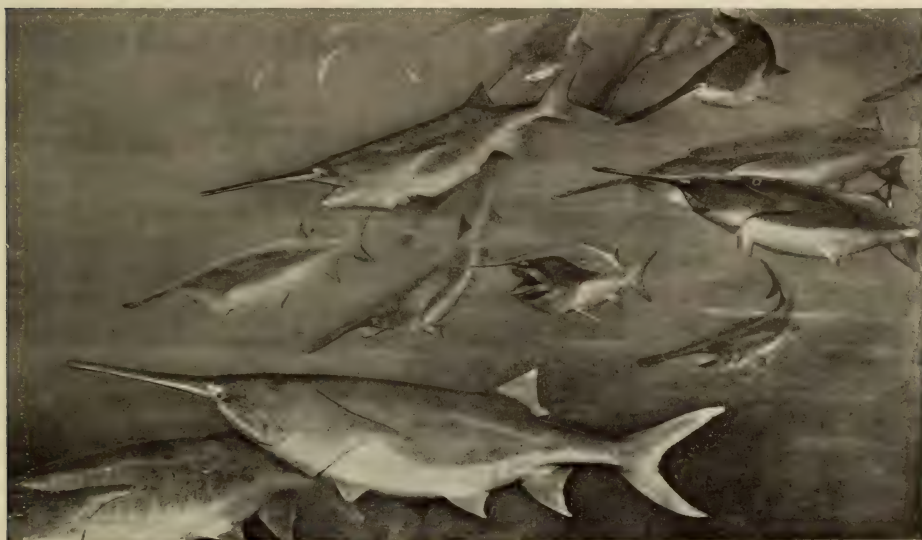
Suspended from the ceiling is the skeleton of a Finback Whale, sixty-two feet in length.

CORRIDOR OF CENTRAL PAVILION

RECENT FISHES

The doorway at the north end of the hall of the birds of the world leading to the rear of the bird of paradise case opens into the gallery of the *Auditorium* and to the corridor devoted to the general collection of recent fishes.

The exhibit includes typical examples of the various groups of back-boned animals popularly comprised in the term "fishes" and is arranged in progressive order. The visitor should first examine the case of hag-



A PORTION OF THE PADDLEFISH GROUP

fishes and lampreys facing the large window. These rank among the most primitive "fishes." They are without scales, without true teeth, without paired limbs, and their backbone consists of but a rod of cartilage.

One of the models shows the way in which a newly caught hag-fish secretes slime, forming around it a great mass of jelly. In the same case are lampreys, and one of them is represented attached to a fish, which it fatally wounds. The nest-building habit of lampreys is illustrated in a neighboring floor case: here the spawners are preparing a pit-like nest and carrying away stones, which they seize with their sucker-like mouths.



THE BOWFIN GROUP

To illustrate the nesting habits of the bowfin, or mudfish (*Amia calva*). At the left the male and female fishes are seen over a nest; at the right a male is standing guard over the eggs. The materials for the group were collected at Fowler Lake, Oconomowoc, Wisconsin, in May, 1912

The visitor should next inspect the cases of sharks which are situated near the entrance hall on the south side. These include various forms of sharks and rays, selected as typical members of this ancient group — for the sharks have numerous characters which put them in the ancestral line of all other groups of fishes.

Next to be visited are the silver sharks or *Chimaeroids*, which are exhibited by the side of the lamprey case. They are now known to be highly modified sharks: their scales have failed to develop, and their heavy "teeth" appear to represent many teeth fused together. These fishes are now very rare and, with few exceptions, occur in the deep sea. The present models show the characteristic forms.

The adjacent case (at the left) pictures the three types of surviving lungfishes, and the models are arranged to indicate the life habits of these interesting forms. Thus, they are shown going to the surface of the water to breathe; and their poses indicate that they use their paired fins just as a salamander uses its arms and legs. In fact there is reason to believe that the land-living vertebrates are descended from forms closely related to lungfishes. One sees in this case also a "cocoon," in which the African lungfish passes the months when the streams are dried up and during which time it breathes only by its lungs.

One now passes into the north aisle of the fish gallery and stops at the first case on the left. Here appear all types of existing Ganoids. These are fishes that represent, as it were, a half-way station between lungfishes and sharks on the one hand, and the great tribe of bony fishes on the other — such as perches, basses, cod, etc. In this case one sees gar pikes, sturgeons, the mudfish (*Amia*), together with the African *Bichir*, a curious Ganoid encased in bony scales and retaining structures which bring it close to the ancestral sharks. A further glimpse of the Ganoids may now be had by returning near the entrance of the fish hall and viewing the spoonbill sturgeon (*paddlefish*) group, in which a number of these eccentric fishes are shown side by side with gar pikes and other characteristic forms from the Lower Mississippi. This group was secured through the Dodge Fund.

Returning then to the north wing of the gallery the remaining cases give characteristic examples of the various groups of modern "bony fishes," or Teleosts. There are twenty-six cases of them in all, but they offer little space in which to illustrate the 10,500 species. For these are the fishes which are dominant in the present age, contributing over nine-tenths of all existing forms and including nearly all food and game fishes, such as bass, cod, eel and herring. One of the cases of the Teleosts exhibits the grotesque fishes from deep water, in which they occur to the surprising depth of over 3,000 fathoms, or more than $3\frac{1}{2}$ miles. They are usually soft in sub-



LUMINOUS DEEP-SEA FISHES

This group represents some of the types of fishes living in the profound depths of the sea, half a mile or more from the surface. The fishes are models made of wax, glass and celluloid, and most of them are several times the natural size.

stance, with huge heads and dwarfish bodies, and are often provided with illuminating organs like little electric bulbs, which can be "shunted off or on" by the fish, and enable the fishes either to see their neighbors or to attract their prey. A group representing a number of these fishes as they are supposed to appear in the gloom of the profound depths, lit up only by their luminous organs, is shown in an enclosure next to the Paddlefish Group mentioned above.

The cases should be examined in the order numbered (beginning with 14); and one may pass in review the catfishes, carps, eels, trout, salmon, pike, mullets, mackerel, basses, wrasses, drumfish, sculpins, cods, flatfishes and anglers.

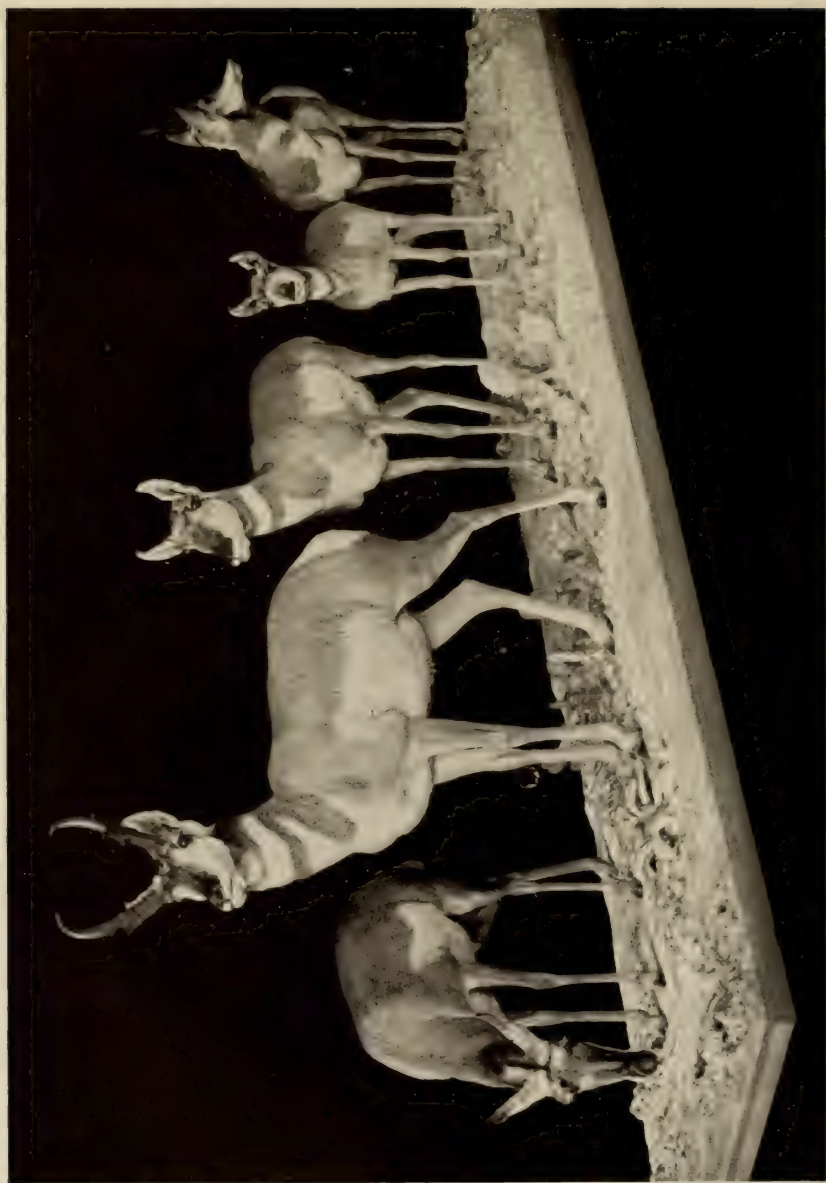
Before the visitor has completed his review of the gallery, he should examine the three wall-cases which explain the characteristic structures of fishes of different groups, and the way in which the groups are related to one another. In one of these wall-cases various kinds of fishes have been arranged in a genealogical tree, and the lines and labels give an idea of their evolution.

Among the conspicuous exhibits of the gallery one notices a sun-fish *(Mola)*, which is the largest example of which we have any exact record (it is 10 ft. 2 in. from tip to tip); also a 12 ft. 9 in. thresher shark, and a gar pike, 7 ft. 4 in. long.

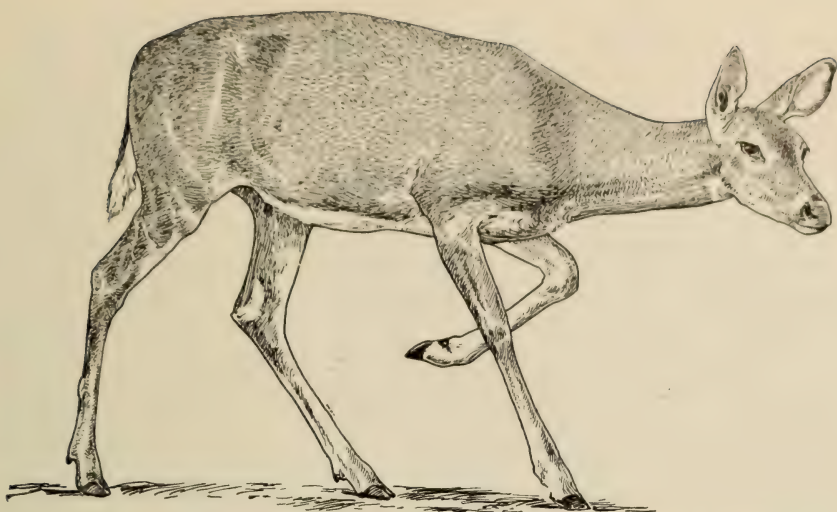
In the window are groups showing the shovel-nosed sturgeon, and the spawning habits of the bowfin and of the slender-nosed garpike.

An exhibit of fossil fishes is to be found on the fourth floor.

[Return to the elevators.]



A GROUP OF PRONGHORN ANTELOPE SHOWING THE MANNER IN WHICH THEY WANDER ACROSS THE PLAINS
This animal is peculiar to North America, and is the only hollow-horned ruminant in which the horn sheaths are shed yearly



THE VIRGINIA DEER — A CHARACTERISTIC NORTH AMERICAN MAMMAL

Line drawing from the mounted specimen. This Virginia doe stands as the first example in the Museum of the new methods of animal sculpture as opposed to the old taxidermy. It was mounted and presented by Carl E. Akeley in 1902

SOUTHEAST WING

MAMMALS OF NORTH AMERICA

Continuing east beyond the elevator corridor, we enter the hall containing specimens of North American mammals, the first to catch the eye being the giant moose of Alaska. In the cases on the west wall are groups illustrating the mammals found within fifty miles of New York City. The first of these groups shows the opossum, the sole representative in the United States of the marsupial or pouched mammals. With what appear to be the head and ears of a pig and the prehensile tail of a monkey, with a strange pouch for the transportation of the young, and with proverbial cunning and remarkable tenacity of life, the opossum is one of the quaintest and most interesting of North American mammals. This is the animal so famous in the negro songs of the South.

Next in order is the raccoon, more commonly known as the "coon." It is nocturnal in habit and makes its nest in hollow trees. Two species of fox are shown, the red fox and the gray fox, both of which are justly famous for their sly cunning.



ALASKAN FUR SEALS

The common skunk is a very useful although greatly abused animal.

Skunk

While it occasionally destroys poultry and other birds, its principal food consists of injurious insects and field mice.

Its defensive weapon is an excessively fetid fluid secreted by a pair of glands situated near the base of the tail. It has the ability to eject this fluid



THE WEASEL GROUP

One of the groups representing the small mammals found within fifty miles of New York City. The others of the series show opossum, raccoon, red and gray foxes, skunk, mink, muskrat, woodchuck, rabbits and squirrels. The list includes some "fur-bearing" species; weasel fur is often used instead of ermine

to a considerable distance. Its skin makes a valuable fur known as "Alaskan sable."

**Mink and
Weasel**

Two other fur-bearing animals shown are the mink and the weasel, the latter in both its summer dress of dull brown and its winter coat of white. Weasel fur is often used in place of ermine.

Muskrat

Another fur-bearing animal shown is the muskrat. In the group are seen its summer home, usually a burrow in the bank of a stream or pond, and its winter mound, constructed of swamp grass and roots mixed with mud. Muskrats are extensively trapped for their fur and in 1913 no less than 4,500,000 were sold in London.



THE AMERICAN BEAVER

This shows the work and home life of the beaver. The old beavers are cutting trees for food and for building dams and houses. In the foreground a house with part torn away to show the little beavers within

The woodchuck or ground hog is a vegetable feeder but does very little harm to crops. It hibernates for a large part of the year usually from September to April. The old legend says that the ground hog comes out of his hole on the second of February and if it is bright and he sees his shadow, he goes back into his hole for six weeks longer and we may expect more cold weather. Other groups represent the varying hare and the common species of squirrels.

In the central section of the hall is a group of moose. It represents an early autumn scene in a second growth forest in New Brunswick, and illustrates one of the favorite feeding grounds of the moose.



BISON COW AND CALF

The big game of North America is described in *Guide Leaflet No. 5, North American Ruminants*

The buffalo group gives a typical bit of the prairie traversed by buffalo trails, while the members of the herd represent different stages of growth of the buffalo. This is the animal which formerly roamed in countless numbers over the western plains but which is now reduced to a few insignificant herds.

On the north side of the hall is a pair of the huge brown bears of Alaska, a family of fur seals from the Pribilof Islands and a family of Rocky Mountain Goats.

At the end of the hall is a group of Roosevelt Elk found in the Coast Range from British Columbia to northern California. Once abundant, they have become much reduced in numbers, though an effort is now being made to preserve them.

Near by is a group of that interesting animal, the Beaver, perhaps the most important of North American mammals and one intimately connected with the early history and exploration of this country

On the south side of the hall are displayed the cloven-hoofed animals of North America. These include sheep, musk ox, caribou, Antelope Group collared peccary and various species of deer. In one of the cases is a group of antelope showing the manner in which they wander across the plains.

Here too are, for the time being, shown the mammals of the polar regions, placed in the North American hall in order that the *Southeast Pavilion*, which once harbored them, may be used as a workroom for the preparation of a group of African Elephants and other mammals from the dark continent. Though the room is closed to the public yet much of the interesting work of preparing these groups may be seen from the gallery above, and later on visitors will be admitted on certain days.

Grant's Caribou Group Grant's caribou inhabit the barren ground of the extreme western end of the Alaskan peninsula. The type specimen of this species is in the Museum.

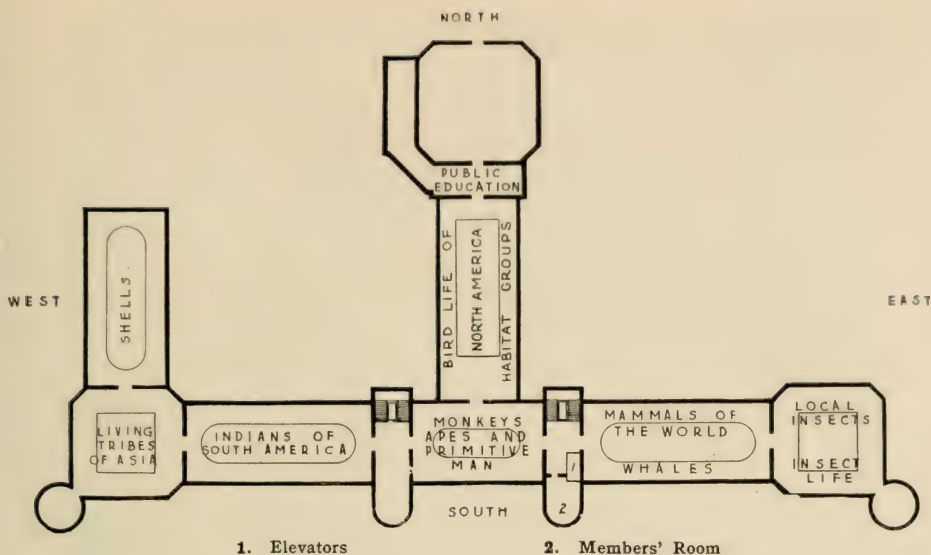
Near by is a group of the Atlantic walrus. These huge mammals are relatives of the seals, inhabit the waters of the far north and are still fairly abundant along the shores of Greenland. Walrus Group The seal and walrus are the animals which play such an important part in the life of the Eskimo. From these animals come the principal food supply, skins for clothing, for fishing and hunting gear, boat covers, and harnesses for dog teams; from bones and tusks are made knives, bows, harpoons, and other hunting and cooking utensils.

The specimens in the musk ox group were collected for the Museum by Admiral Peary in 1896. Musk oxen inhabit the snow-covered wastes of the Arctic barrens, living mainly upon willow leaves, dug up from under the snow.

Note the various devices in the way of labels introduced to make the exhibits interesting and instructive. At the entrance attention is called to the principal causes influencing the distribution of mammals; on many of the labels are maps showing the range of the species shown, and near the group of Mountain Sheep is a label including a map and miniature models illustrating the species of North American mountain sheep and their range.

SOUTHEAST PAVILION

Being used as a workroom; see paragraph above.



THIRD FLOOR EAST CORRIDOR

Members' Room

Thorne Tablet

To the left of the elevators is a room set apart for the use of honorary or subscribing members of the Museum, where they may leave their wraps, rest, write letters or meet their friends. Near by is a bronze tablet in memory of Jonathan Thorne, whose bequest provides for lectures and objects for the instruction of the blind.

SOUTH PAVILION

MONKEYS, APES, RODENTS, BATS

This is one of the halls in course of rearrangement and, in the final plan, is intended to include primitive man as well as the other members of the order Primates.

The family of orang-utans, on the south side, was one of the first groups of large animals to be mounted in this country, and was considered a daring innovation. Near by are examples of the gorilla, the largest and most powerful of the great apes and the chimpanzee, which is the most like man in proportions and structure. "Mr. Crowley," one of the few full grown apes that have endured captivity, lived for some time in the Central Park Zoo. Skeletons of man and the large apes illustrate the similarities and difference in structures between them.

The bats, the only mammals that really fly, and rodents, the most numerous and widely distributed of mammals are provisionally placed in this hall pending other arrangements.



DUCK HAWK ON PALISADES OF THE HUDSON

Realism and artistic effect have been achieved in the "Habitat Bird Groups," and they present vividly many stories of adaptation to environment

The fruit bats, often known as flying foxes, the largest members of the order and found only in the warmer parts of the Old World, are represented by a small portion of a colony from Calapan, Philippine Islands. Such a colony may number several thousands, and be very destructive to bananas and other fruits.

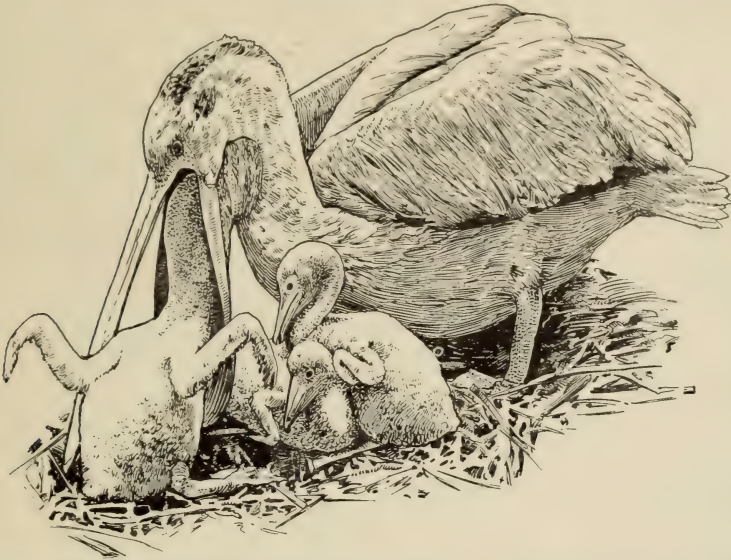
Suspended from the ceiling in the center of the hall is the skeleton of a medium sized North Atlantic right whale, a species once common on our coast, but now all but exterminated in the North Atlantic.

SOUTH CENTRAL WING

BIRD GROUPS

Here are the "Habitat Groups" of North American Birds. This unique series of groups shows the habits of some typical American birds in their natural haunts. The groups have been prepared under the immediate direction of Frank M. Chapman, Curator of Ornithology, who collected most of the specimens and made practically all of the field studies necessary for their reproduction. In the course of this collecting, he traveled more than 60,000 miles. The backgrounds are reproductions of specific localities, painted from sketches made by the artist who usually accompanied the naturalists when the field studies for the groups were made. Practically all

sections of the country are represented, thus the series not only depicts characteristic bird life of North America but characteristic American scenery as well. The backgrounds of the groups were painted by Bruce Horsfall, Charles J. Hittell, J. Hobart Nichols, Carl Rungius, W. B. Cox and Louis A. Fuertes. The foliage and flowers were reproduced in the Museum laboratories from material collected in the localities represented. Each group is fully described in the label attached to the case. [See *Guide Leaflets* No. 28 and No. 22.] Beginning with the case at the right of the entrance and passing on to the right around the hall, we find the groups arranged in the following sequence:



White pelican from Klamath Lake Group, Oregon. One young bird is illustrating its amusing method of procuring food from its parent's throat

The distribution of birds, notwithstanding their powers of flight, is limited in great measure by climate. Thus in traveling from Panama north to Greenland there are zones of bird life corresponding to the zones of temperature. This condition is illustrated in the mountain of Orizaba in Mexico, where in traveling from the tropical jungle at its base to its snow clad peak the naturalist finds zones of life comparable with those to be found in traveling north on the continent. Thus the Orizaba group so far as the distribution of life is concerned is an epitome of all the groups in the hall.

**Orizaba
Group**

Among our most beautiful and graceful shore birds are the terns and gulls, which (because of their plumage) have been so ceaselessly hunted and slaughtered for millinery purposes that now in their breeding places there are only hundreds where formerly there were thousands. The group represents a section of an island off the Virginia coast where the birds are now protected by law.

**Cobb's Island
Group**



THE ORIZABA GROUP

The observer is looking across the valley of the Rio Blanca, over the tropical forest, to Mount Orizaba

The duck hawk may be found nesting on the Palisades of the Hudson almost within the limits of New York City. It builds

nests on the ledges of the towering cliffs. This hawk is a near relative of the falcon which was so much used for hunting in the Middle Ages.

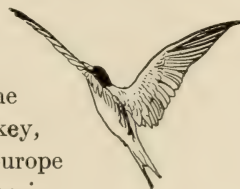
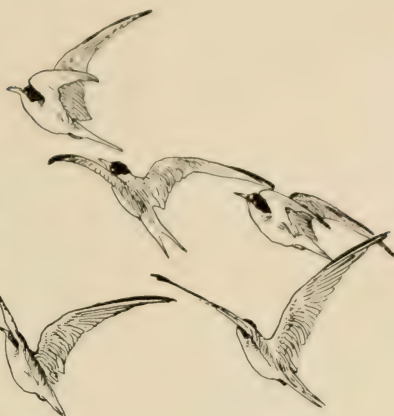
In August and September the meadows and marshlands in the vicinity of Hackensack, New Jersey, are teeming with bird life. In the group showing these Hackensack meadows are swallows preparing to migrate southward, bobolinks or rice birds in fall plumage, red-winged blackbirds, rails and the wood duck.

The wild turkey is a native of America and was once abundant in the wooded regions of the eastern portion of the United States, but is now very rare. It differs in color from the Mexican bird, the ancestor of our common barnyard turkey, which was introduced from Mexico into Europe about 1530 and was brought by the colonists to America.

(Reproduced from studies near Slaty Forks, West Virginia.) Cobb's Island Group

The great blue heron usually nests in trees. The bird flies with its neck curved back on its body and because of this habit can readily be distinguished from the crane with which it is frequently confounded. (Reproduced from studies near St. Lucie, Florida.)

In the "bonnets" or yellow pond lily swamps with cypresses and cabbage palmettoes, the shy water turkey builds its nest. It receives the name "turkey" from its turkey-like tail and the title "snake-bird" from its habit of swimming with only the long slender neck above water. (Reproduced from studies near St. Lucie, Florida.)



Terns

Duck Hawk
Group

Hackensack
Meadow
Group

Wild Turkey
Group

Florida Great
Blue Heron
Group

Water
Turkey or
"Snake-bird"
Group

The sandhill crane builds its nest of reeds in the water. Unlike the herons in this respect, it differs also in its manner of flight, always stretching its neck well out when on the wing. (Reproduced from studies on the Kissimmee Prairies of Florida.)

Pelican Island on the Indian River of Florida has been made a reservation by the United States Government and these grotesque birds may now breed there undisturbed. The view shows a section of the island at the height of the nesting season. Notwithstanding the hundreds of young birds that are clamoring for food, observation has shown that the parent bird can pick out its own offspring with un-failing accuracy. (Reproduced from studies at Pelican Island, Florida.)

This beautiful bird has been brought to the verge of extinction in this country through the use of its "aigrette plumes" for millinery purposes, and is now confined to a few protected rookeries of the South. The birds have these plumes only during the nesting season, at which time the death of the parent means the starvation of the young. (Reproduced from studies in a rookery of South Carolina.)

The turkey vulture or buzzard is one of the best known birds of the South where it performs a valuable service in acting as the scavenger of the streets. On this account it is protected by law and by public sentiment and has become both abun-



A PORTION OF THE EGRET GROUP

As shown here the birds carry their plumes only during the nesting season; killing the parents means the slow starvation of the young

dant and tame. (Reproduced from studies at Plummer Island in the Potomac River, near Washington.)

The California condor is the largest and one of the rarest of North American birds. It is not so heavy as the condor of the Andes but has a slightly greater spread of wing, eight and one-half to eleven feet. In the group the visitor is supposed to be standing in the interior of the cave where the bird has its nest and is looking down on the river of the cañon which is more than five thousand feet below. (Reproduced from studies in Piru Cañon, California.)

The foreground of the group shows a detail of the island that is painted in the background. The young birds are feeding and it will be noticed that one fledgeling is reaching well down the mother's throat after the predigested food. (Reproduced from studies at Monterey, California.)

Formerly this area was an arid place with a characteristic desert bird fauna. Now the ranchmen have irrigated the land and aquatic bird life abounds. This group is a good illustration of the influence of man on the bird life of a region.

In the breeding season the flamingos congregate in great numbers in their rookeries. There were estimated to be two thousand nests in this colony. The flamingos construct their nests by scooping up mud with their bills and packing it down by means of bills and feet. The nests are raised to a height of twelve or fourteen inches; this protects eggs and young from disasters due to high water. Only one egg is laid in the nest, and the young is born covered with down like a young duck and is fed by the mother on predigested food. The brilliant plumage of the adult is not acquired until the fifth or sixth moult. (Reproduced from studies in the Bahama Islands.)

In this group is shown a portion of a coral islet on which three thousand boobies and four hundred man-of-war birds were nesting, the former on the ground, the latter in the sea grape bushes. (Reproduced from studies in the Bahama Islands.)

The abundance of bird life in one of these rookeries is quite astounding. In this group are roseate spoonbills, snowy egrets, American egrets, little blue herons, Louisiana herons, ibises, cormorants and water turkeys. Because of the great inaccessibility of this island it has been one of the last places to escape the depredations of the plume-hunter. (Reproduced from studies in the Everglades of Florida.)

The golden eagle is one of the most widely distributed of birds. In



A FLAMINGO COLONY IN THE BAHAMAS

A "city" of these birds is the most remarkable sight in the world of birds. The mud nests are raised from eight to fourteen inches, and thus protected during rise of water

North America it is now most common in the region from the Rockies to the Pacific coast, although it is found as far east as Maine. Golden Eagle Group Stories to the contrary notwithstanding, the eagle never attacks man even though the nest is approached.

Its food consists of rabbits, squirrels, woodchucks and occasionally sheep. (Reproduced from studies near Bates Hole, Wyoming.)

The abundance of bird life in this western lake beneath Mt. Shasta, which is seen in the center of the background, is astonishing. Here is an example of how the normal nesting habits of a bird may be changed by its being driven into a different locality. In Klamath Lake Group the group are white pelicans which usually make a nest of pebbles, Caspian terns which commonly build their nests on sand, and cormorants that nest on rocks, all nesting together here on the tule or rush islets of the lake. (Reproduced from studies at Klamath Lake, Oregon.)

The scene represented in this group is above timber line on the crest of the Canadian Rockies — 8,000 feet above the sea. Although these mountains are in the temperate region the altitude gives climatic conditions that would be found in the far north, and the bird life is arctic in character. Here are nesting the white-tailed ptarmigan, rosy snow finches and pipits. (Reproduced from studies in the Canadian Rockies.) Arctic-Alpine Bird Life Group

This group shows a stretch of western plateau covered with sage bush. In this bush is seen the male sage grouse strutting and wooing a mate. (Reproduced from studies at Medicine Bow, Wyoming.) Sage Grouse Group

The prairie chickens are akin to the common grouse. The group represents a typical scene during the mating season. The male birds go through most surprising antics in their efforts to attract the females. They inflate the orange-colored sacs on the sides of their necks, dancing and strutting about and uttering a loud, resonant, booming note. (Reproduced from studies near Halsey, Nebraska.) Prairie Chicken Group

The wild goose is one of the first birds to migrate north in the spring. It nests in the lakes of Canada even before the ice is melted. To secure the young birds for this group it was necessary to hatch the eggs of the wild goose under a hen, so difficult is it to find the young in nature. (Reproduced from studies made at Crane Lake, Saskatchewan, Canada.) Wild Goose Group

The grebe is another of our aquatic birds which builds its nest near the water. During the incubation period the parent bird usually covers the eggs with grass and reeds when leaving the nest. Nesting at the same lake with the grebe was the Grebe Group

redhead duck, which lays from fifteen to twenty eggs. (Reproduced from studies made at Crane Lake, Saskatchewan, Canada.)

The loon is justly famed for its skill as a diver, and can swim with great speed under water. Its weird call is a familiar sound on the northern New England lakes. Many loons pass the winter at sea fifty miles or more from land. (Reproduced from studies at Lake Umbagog, New Hampshire.)

This rocky island thirty miles from shore in the Gulf of St. Lawrence affords

some protection to the sea birds which still nest in great numbers

on and in its cliffs, although the colony is a mere shadow of what it was even fifty years ago. Seven species are shown nesting in the group. Namely the razor-billed auk, petrel, gannet, puffin, kittiwake gull, common murre and Brunnich's murre. (Reproduced from studies at Bird Rock, Gulf of St. Lawrence.) This was the first habitat group.

[Return to the South Pavilion containing the apes and monkeys.]



Love making of the prairie chicken. In this position and with orange-like air sacks inflated, he produces a booming sound which may carry a distance of two miles

WEST CORRIDOR

PUBLIC HEALTH

Returning to the South Pavilion where the monkeys are, and passing to the right, we enter the *West Corridor* containing the exhibits of the Department of Public Health.

The Hall of Public Health is dominated by a bronze bust of Louis Pasteur, the founder of scientific bacteriology and preventive medicine, which was presented to the Museum through the courtesy of the Pasteur Institute of Paris. Near the head of the stairway is a reading table where pamphlets bearing on insect borne disease and other public health problems may be consulted.

The first section of the exhibit deals with the natural history of water supply as it affects the life and health of man. Large photographs at the entrance to the corridor on the left illustrate the primary source of water supply, the clouds, and the secondary sources, the rivers and lakes. Diagrams, models and a relief map show the variations in rainfall at different points in the United States. Relief maps of the region about Clinton, Massachusetts, before and after the construction of the Wachusett Reservoir for the water-supply of Boston, show the way in which surface water supplies are collected by impounding streams, and a model of a well sunk through impervious to water-bearing strata shows how ground-water supplies are obtained. A series of samples and models illustrate the variations in composition which occur in natural waters, from the swamps of Virginia to the deep wells of Iowa and the turbid rivers of the Ohio valley.

Some of the principal micro-organisms, Algæ and Protozoa, which grow in reservoirs and impart tastes and odors to water are represented by a series of glass models. The effect produced by the pollution of water by disease germs is illustrated by relief maps and diagrams showing the course of famous typhoid and cholera epidemics. Models are displayed which illustrate the purification of water by storage, filtration and disinfection, the filter model being an elaborate representation of the plant at Little Falls, N. J. Diagrams and models indicate the results of water purification as measured both in dollars and cents and in the saving of human life. Finally a series of five large relief maps shows the growth and development of the water supply of New York City.

Following the water-supply exhibit is a series of models illustrating the dangers from improper disposal of the liquid wastes of the city and how they may be avoided. Actual points of danger in the neighborhood of New York are shown where polluted harbor waters, bathing places and shell-fish beds are a menace to health. The modern methods for the treatment of sewage on scientific lines are illustrated by a series of models of screens, sedimentation tanks and filter beds of various types.

The cases near the window are devoted to the group of Bacteria, especially in their relation to human life. Glass models show the various shapes and relative sizes of these minute forms and in particular of the principal types which cause disease. In a nearby case are displayed actual colonies of a number of species of bacteria including some which produce disease and others which are beneficial to man by their effect upon soil fertility or the fact that they may be utilized in the production of substances useful as foods or in the arts. A group of transparencies at the window shows some of the more important disease bacteria as they appear under the microscope.



THE HOUSE FLY OR TYPHOID FLY

Model 64000 times the bulk of a fly. By Ignaz Matusch from his original studies

Another series of exhibits deals with the transmission of disease by insects, notably by the fly and flea. The most striking feature of these is a model of the fly, a little over a foot in length, and having the bulk of 64,000 flies. This, the finest model of the kind ever made, was prepared by Ignaz Matusch from his original studies, and required nearly a year of constant, exacting labor.

The egg, larva and pupa of the insect are also shown modeled on the same scale.

Models in the wall case deal with the life history of the fly showing its various stages in their natural size and actual habitat and illustrate the large numbers of flies which may breed in a single pound of manure and the enormous progeny which may spring from a single pair and their descendants during the breeding season.

The deadly work of the fly in carrying typhoid fever is illustrated by a representation of two companies of soldiers, showing the comparative mortality from flies and bullets during the Spanish-American war. One company confronted by a cannon, suffers the loss of one man wounded; another facing a tube of typhoid germs — distributed by flies — has one dead and thirteen in the hospital.

Wall drawings near by show how the fly may carry typhoid bacilli on its foot, with the number of bacteria found on flies in sanitary and unsanitary surroundings; and illustrate the allied species, the stable fly, which it is thought may carry infant paralysis and other diseases.

Nearby are two models showing unsanitary and sanitary conditions on a small farm. In one, pools of stagnant water and uncovered manure heaps and general uncleanness favor the breeding of mosquitoes and flies, while the open doors and windows give these insects free access to the house. In the other, the swampy land is drained and cultivated, the windows screened, the shallow dug well replaced by a driven well; the conditions are sanitary and health and prosperity replace sickness and poverty.

Various types of traps for larvae and adult flies are shown with models illustrating how fly breeding may be prevented and how human wastes may be protected from their access.

The relation of the flea and the rat to the terrible disease bubonic plague is illustrated in considerable detail. Wall charts illustrate the spread of the great historic epidemics of this disease and reproductions of sixteenth and seventeenth century drawings show with what terror the Black Death was regarded in pre-scientific days. The chief carrier of the disease, the flea, is shown in a remarkable model 120 times the length of the actual insect and having the bulk of 1,728,000 fleas, prepared by Ignaz Matusch.

Specimens of some of the principal animals which harbor the plague germ and serve as reservoirs from which it is carried by the flea to man (the black,

brown and roof rats, the wood rat and the California ground squirrel) are shown and the manner in which the disease is disseminated is illustrated by a copy of a corner of a rat infested house in California. The original from which this was copied as well as many of the rats and squirrels were obtained through the courtesy of the U. S. Public Health service of Washington. Preventive measures against the plague are illustrated by models of a farm with buildings rat-proofed and of a ship at a dock equipped with guards to prevent the access of rats to the shore.

In a window case are shown various stages of the common mosquito, Culex, as well as of Anopheles, the carrier of malaria and, **Mosquitoes and Other Insect Carriers of Disease** Aedes, which is responsible for the spread of yellow fever. In the same case are specimens of other insect carriers such as the flea, the bedbug and the louse. Small cases flanking the windows contain specimens of the Glossinas which transmit sleeping sickness and the Nagana disease in Africa and of the ticks which spread Texas fever of cattle and relapsing fever, African fever and Rocky Mountain Spotted Fever of man. Nearby are shown maps indicating the area affected by the principal tick fever in the United States and a model of a dipping vat used in freeing animals from tick infestation.

A series of models and diagrams is devoted to the life history of the **Mosquitoes and Malaria** Anopheles mosquito and its relation to malaria. A relief map of the State of Arkansas illustrates the coincidence between low swampy lands and the prevalence of malaria and another shows the heavy incidence of malaria in the vicinity of marsh-lands near Boston. A full size model and a small relief map indicate the type and arrangement of drains used for lowering the water level and eliminating mosquito breeding pools and diagrams illustrate the progress made in mosquito control in New Jersey and the financial return which has resulted.

Two tree trunks, one normal and the other infested with fungi as a result of mechanical injury illustrate the important fact **Vital Resistance and Disease** that the normal plant or animal is able to resist disease while anything which tends to lower vital resistance may open the way for the invasion of pathogenic germs.

[See *Guide Leaflet No. 33.*]

The collection of Auduboniana, or objects relating to the life and works **Auduboniana** of John J. Audubon, presented to the Museum by his granddaughters, Maria R. and Florence Audubon, occupies the stairway hall. It includes original sketches and paintings by Audubon and his sons, illustrations in various stages from the Quadrupeds of North America, and some of the copper plates of the Birds of North America. The most important piece is a large painting of a covey of "English" pheasants, flushed by a dog recently presented by Miss M. Eliza Audubon. Of more personal interest is the gun carried by Audubon on many of his expeditions and a favorite buckskin hunting coat.

SOUTHWEST WING

INDIANS OF SOUTH AMERICA

Passing through the west corridor, where the exhibit of the Department of Public Health is installed, and on into the adjoining hall to the west, we find the collections from South America. The greater part of the hall is filled with archaeological material illustrating the various forms of culture existing in Colombia, Ecuador, Peru, Bolivia and Chile in prehistoric times. The remains found in Peru, in parts of Central America, and in Mexico show a degree of culture far in advance of that attained in any other part

Indians of
South
America



PIECES OF CLOTH FOUND WITH PERUVIAN MUMMIES

The prehistoric Peruvians were familiar with modern weaves including the finest gobelins and produced highly decorative effects by harmonized colors and a repetition of woven-in designs. The Museum's collection of mummy cloths is one of the largest in the world, and is much used by teachers and students of art

of this continent in prehistoric times. Unlike the ancient peoples of Mexico and Central America the Peruvians had no written language. They were tillers of the soil and raised maize, potatoes, oca, quinua, beans, coca and cotton. The Incas domesticated the llama, which was used as a beast of burden. They excelled in the manufacture and decoration of pottery vessels, in metalwork, and in textile fabrics. In the case directly in front of the entrance are displayed gold and silver objects such as beads, cups, pins and ear ornaments which show the high degree of skill attained in the beating, soldering and casting of metals. In weaving they were perhaps preeminent among prehistoric peoples, many of their specimens exhibited here being unsurpassed at the present day. The materials used were cotton and the wool of the llama, alpaca and vicuna. In the first cases on the right are examples of these textiles with looms and shuttles. [The musical instruments of ancient Peru are discussed in *Guide Leaflet No. 11.*]

The alcove cases are geographically arranged, showing exhibits from



PERUVIAN MUMMY BUNDLES AND MUMMY

The ancient Peruvians wrapped their dead in fabrics of fine cotton and wool, then covering with a sack of strong cloth. The mummy "bundle" thus produced was often given a "false head" of cloth filled with cotton or vegetable fibre. Climatic conditions in Peru have preserved these mummies and their wrappings during many centuries.

the north toward the south of South America, then up into the interior of the continent. In the wall cases extending across the entire western end of the hall will be found a remarkable collection from Nazca, Peru. The prehistoric people of Nazca excelled as colorists, particularly in the decoration of their pottery vessels which are certainly the most beautiful so far discovered in South America.

The special exhibits in the gallery rail cases include quipus used to



AN EXAMPLE OF NAZCA POTTERY

keep accounts, charms and medicines, coca which was chewed with lime, and shells that were found in mummy-bundles and in the graves. A number of the chicha jars are on exhibition on top of the cases.

In the first case to the left (south side) is a collection of skulls showing many examples of trephining, artificial deformation and pathological conditions, together with a number of normal Peruvian skulls for comparison.

**Trephined
Skulls**

The wall case at the left of the entrance contains mummy bundles and various objects showing the burial customs of the Peruvians. In no part of America are found so many and so extensive burial places as in the coast region of Peru. Here were interred countless thousands of the ancient dead. In the *huacos* or graves, with the bodies, were placed such articles as had been most useful and highly prized during life, and such as it was considered would be most serviceable in a future life.

**Mummy
Bundles**

To this custom we are indebted for no small part of our knowledge of the daily life of the ancient Peruvians. From the mummy bundles and



TREPHINED SKULLS FROM PREHISTORIC PERUVIAN GRAVES

graves all the objects in the extensive collections in this hall, illustrating their civilization have been obtained. The wonderful state of preservation shown in the textile fabrics and other perishable materials from the coast regions is due to the extreme dryness of the climate and the nitrous character of the soil. [See *Guide Leaflet* No. 24.]

The mummy in the case at the west end of the room was found in a copper mine at Chuquicamata, Chile. The body is that of an Indian miner who was killed by the falling in of rocks and earth while engaged in getting out the copper ore (atacamite) used by the Indians in making implements and ornaments in prehistoric times. The tissues of the body have been preserved by copper salts with which it is impregnated. The implements he was using at the time of his death are shown beside him in the case.

On the south side of the hall are the ethnological collections from Brazil, British Guiana, Paraguay and Colombia. War implements, basketry, featherwork and musical instruments etc. are arranged in these cases.

SOUTHWEST PAVILION

CHINESE AND SIBERIAN COLLECTIONS

If we pass on into the hall at the extreme west end of the building, we



ANCIENT CHINESE BRONZE

Collections
From Asia

find collections from eastern and northern Asia. The arrangement is geographical. Read carefully the label at the entrance to the hall. Specimens illustrating the culture, industries, religion and manufactures of China are on the left; others showing the mode of living, the costumes and the war implements of Siberia are on the right. The furwork, costumes and rugs of the people of East Siberia reveal remarkable skill in workmanship. Two models show respectively summer and winter scenes in Siberia. A small model in one of the cases to the left shows the manner of making pottery. A series of frames in the rear contain pieces of various kinds of fabrics and patterns illustrating weaving and woodwork ornaments.

The collections deal mainly with



BLACK HELMET OR CAMEO SHELL

From the Morgan Collection. This species, found in the West Indies is the one most commonly used for cutting cameos

the everyday life of the Modern Chinese and have a special value as they were made just before the sweeping changes of the last few years took place. These abolished many of the customs in which these objects were used; for example, the series of weapons and objects showing the tests to which a soldier was submitted on entering the army have been rendered obsolete by the introduction of modern weapons and tactics. Bamboo, porcelain, basketry, inlaid work, cloisonne enamel, agricultural implements, carvings in wood, ivory and stone, and embroidery are exhibited.

A special collection of great value is found in the ancient bronzes shown in the adjoining tower room.

WEST WING

SHELLS

The collection of shells installed in the *West Wing* contains altogether about 100,000 specimens representative of nearly 15,000 species. These show extraordinary range of color and ornamentation. The arrangement of the collection is as follows: first, in the south wall cases a series showing briefly the classification of mollusks; second, in the eight table cases at the north and south ends of the hall the collections of land shells; third, in the upright railing cases the bivalves or mollusks which like the common clam have two shells; fourth, in the sloping cases the univalves, mollusks which have only one valve or shell like the snails; fifth, special exhibits of shells in the north wall cases. Other cases contain exhibits illustrating the anatomy and habits of mollusks; colored transparencies show them in their habitats.

Short descriptive group labels will be found in the cases, and on the walls, picture labels of important families of shells, together with small maps of distribution defining the occurrence of the same throughout the world and a large map showing the regional distribution of marine shells.

An interesting collection of deformed shells is seen in the north case, and a series illustrating the ornamental uses of shells. Cases of especial beauty in their shell contents are those holding *Murex*, *Fusus*, *Voluta*, *Conus*, *Oliva*, *Strombus*, *Cypraea*, *Nisitra*.

[Return to the South Pavilion, containing the apes and monkeys.]

SOUTHEAST WING

MAMMALS OF THE WORLD

Proceeding east from the hall where are the apes and monkeys, we pass the elevators, to enter the hall of the *Southeast Wing*, devoted mainly to the Principal Families of Mammals and their Evolution in Past Ages. The exhibits read like the pages of a book from left to right, being arranged

**Mammals of
the World**

to bring out the phylogeny or past history and development of the chief divisions of mammals. The specimens are arranged not on shelves but close against the background

of the case on small projecting supports and from each a cord has been stretched down along the background to a diagrammatic representation of the geological periods. In this way are indicated the relationships of the various animals to one another as well as the geological age in which each animal probably originated. Circling the hall above the cases is a mural frieze representing marine scenes, which serves as a background for groups of porpoises, dolphins and other small members of the whale family. The most striking object in the hall is the life-size model of a sulphur-bottom whale, seventy-nine feet in length. The original of this specimen

**Model of
Sulphur-
bottom
Whale**

was captured in Newfoundland and the model is accurately reproduced from careful measurements. This huge creature is not only the largest of living animals, but, so far as we know, the largest animal that has ever lived: A specimen of this size weighs from sixty to seventy tons, about twice as

much as *Brontosaurus*. As can be seen by examining the models of a whale's head attached to the pillar, the whalebone which takes the place of teeth hangs in great plates from the inside of the upper jaw. This whalebone acts as a strainer in the mouth of the whale and extracts the small animals from the sea water which the whale takes into his mouth when feeding. The food consists mostly of tiny crustaceans less than an inch in length. Although whales and porpoises live in the water they are not fishes, but are warm-blooded and breathe by means of lungs, not gills. The whale must come to the surface to breathe and the so-called "spouting" is merely the result of the warm air being expelled from the lungs when he breathes. A whale does not spout *water* as is commonly supposed. Models to scale of the other whalebone whales, and the toothed sperm whale, and skeletons of the smaller whales are hung near for comparison.

The plans for the next addition to the Museum building include a large hall to contain whales and other marine animals.

In the railing cases are exhibits which aim to give the visitor a general view of the enormous Class of Insects. This series is, at present, being rearranged and improved. When finished, it will include representatives

of all the principal families, exotic as well as native. A special exhibit of the common Butterflies near New York City and another of the "Moths of the Limberlost" has been installed. There is also one showing butterflies found in North Temperate America. There are nearly half a million species of insects in the world so that, even when finished, this series can contain only a small part of the total. Furthermore many of the species would fade rapidly if exposed to the light. The general study collection of insects is on the fifth floor and while it is not on exhibition, the curators are glad to show it to visitors who can make use of it. See the Southeast Pavilion for the study collection of local insects.

SOUTHEAST PAVILION

HALL OF INSECT LIFE

Still going east, we enter the *Insect Hall*. The installations in this hall point out the relationships, through origin and mode of life, of insects to each other and to the other members of the Animal Kingdom, especially to man. The exhibits are arranged in a continuous series and are numbered so that we can easily follow the plan beginning at the pillar farthest to the left.

First is an introductory section illustrating by diagrams the importance of insects as shown (a) by the large number of species compared with other animals [there are more species of insects than of all other animals put together] and (b) by their great influence on human interests. In the United States, the economic loss by insects is more than five times as great as by fire and there are more than twelve times as many deaths from insect-borne diseases as from railroad accidents. On the other hand, many of our crops and all beautiful flowers are largely dependent upon pollination by insects.

Following this are a number of sections showing the relationships of insects to other animals, explaining the terms used in the classification of insects and exhibiting typical examples of the principal families.

There is then given a summary of the principles underlying evolution as illustrated by insects. This series concludes with a discussion of the Mendelian Law of Inheritance which has been so greatly elaborated by experiments on the common fruit fly, *Drosophila ampelophila*.

Insect life in its various phases follows, leading up to the economic relations between insects and man. The latter topic is introduced by a consideration of insects' enemies, including man, and then certain insects are shown as enemies of man.



GROUP OF MIGRATORY BUTTERFLIES

It concludes with exhibits of silk worms and honey bees — insects whose products are commercial commodities. In connection with the honey bee, other social insects are exhibited.

There is then a series of sections devoted to insects in art and literature, concluding with photographs of prominent entomologists and instructions concerning the collection and preservation of insects. [*See Guide Leaflet No. 39.*]

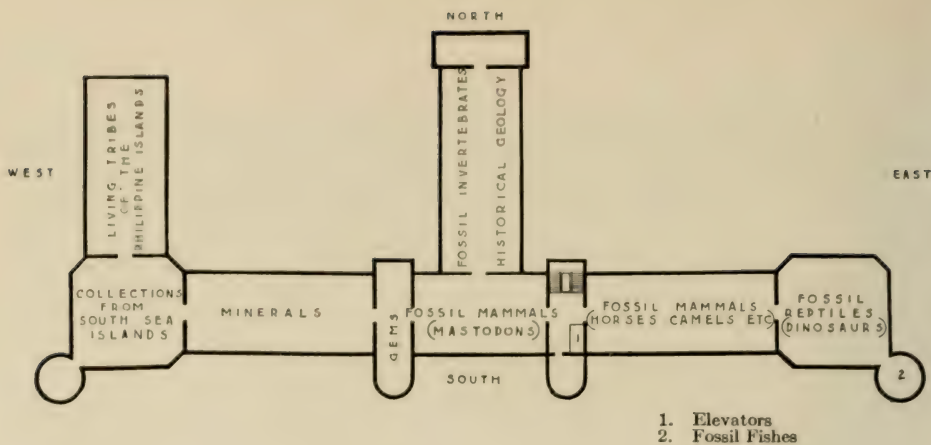


PART OF THE CICADA GROUP

Visitors desirous of studying the local insects more in detail are cordially invited to do so by consulting the nearly complete collection to be found in this hall under the custody of the New York Entomological Society which holds its meetings in an adjoining room.

It is primarily intended to be an aid in the identification of specimens and is not a part of the general exhibition series.

(Return to the elevators and ascend to the Fourth Floor.)



FOURTH FLOOR

FOREWORD ON FOSSIL VERTEBRATES

In the *East Corridor*, and the *South Pavilion* at the left, as well as in the *East Wing* and *Southeast Pavilion* at the right are displayed fossil mammals, reptiles and fishes.

In a general way, fossils are the petrified remains of plants or animals that lived at some past period of the earth's history. In many instances we have not the objects themselves but only their casts or impressions in the rocks. This is particularly the case with shells. Sometimes, as with the bones of the great Irish elk the objects have been buried in swamps or bogs, and in a few rare instances as with the mammoth and woolly rhinoceros, entire animals have been preserved for thousands of years in ice or frozen mud. Fossils are found in localities where the dead animals or plants have gradually been buried under layers of sediment to such a depth that they come in contact with the mineral waters of the earth and finally become petrified. Later through subsequent upheaval and erosion they are again brought to or near the surface of the earth. Petrification is the slow replacement of animal or vegetable material by such minerals as carbonate of lime or silica. The process is very slow and for this reason flesh is never petrified. Fossil beds are found in every continent. In our own country, Texas, Montana, Wyoming, and the Bad Lands of South Dakota are famous for their large fossil beds, and many of the finest and rarest fossils in the Museum were obtained in these localities.

As it takes thousands of years for the various layers of earth to accumulate over the bones, and for the latter to become petrified, the study of fossils and the strata in which they are found is an important aid in determining the age of the earth and the succession of life thereon. Many of the skeletons exhibited in these halls are of animals which lived from 30,000 to 20,000,000 years ago. To prepare a specimen for exhibition the

matrix in which the bones are imbedded is carefully chipped away and the missing parts restored in cement and plaster. The bones are then assembled as in life. In the specimens on exhibition the restored parts differ in color from the original parts of the skeleton and can readily be distinguished.

As a whole, the Museum collections of fossil vertebrates are believed to be the finest in the world, if we take into consideration not merely numbers, but also variety, quality and perfected methods of preparation and exhibition. The collections illustrating the evolution of the horse are probably equal to those of all other institutions combined. The collections of Permian reptiles, of Jurassic and Cretaceous dinosaurs, of turtles, of North American Tertiary mammals, and of extinct mammals of South America, are likewise of the first rank. There are more than seventy complete skeletons on exhibition, several hundred skulls and nearly two thousand jaws or other parts of various species. About ten times this number are in storage, reserved for study and research, or not yet prepared for exhibition.

EAST CORRIDOR

Fossil Fishlike Lizards

Directly in front of the elevator is a wall case in which the most recently acquired specimens are placed. The cases attached to the wall near the stairway contain specimens of huge marine fishlike lizards, which show the tremendous pressure to which fossils are often subjected and the fragmentary condition in which they are found.

SOUTH PAVILION

MASTODONS AND MAMMOTHS

The visitor should first enter the *South Pavilion* in which are shown the skeletons of mammoths and mastodons, the prehistoric relatives of the modern elephants, and of the curious and extraordinary extinct animals which inhabited South America in prehistoric times, 30,000 to 100,000 years ago. On the left is a series of modern skeletons illustrating the evolution of the horse under the hand of man. Here are such extremes as the Shetland pony, only two feet ten inches high, and the rough-boned draught horse, which stands six feet one inch in height. Contrast these with the slender-limbed "Sysonby" the famous race horse, and the Arabian stallion "Nimr." Man by his intelligence has modified the form of the horse to meet his needs and has accomplished in a small degree but rapidly, what nature has done in an extensive way during long ages — as will be seen from the fossil horses in the next hall. The similarity in structure of the skeletons of horse and man is brought out in the exhibit of a rearing horse being controlled by man. A comparison of these two skeletons will show that with some modification the bones of the



THE GROUP OF GIANT GROUND SLOTHS

Fossil mammals from South America adapted for digging about the roots of trees for the purpose of pulling them down to feed on the leaves and twigs

(See Reprint, *THE GROUND SLOTH GROUP*, for a full description and Reprint the Ancestry of the Edentates for classification)

one correspond with the bones of the other. The horse lover will also be interested in the osteological collections in the wall cases which show how to tell the age of horses through the growth and development of the teeth.

Beyond the Horse exhibit on the left are fossils from South America, the most striking of which is the group of giant ground sloths. There are also good examples of the Glyptodon, a gigantic relative of the armadillo, of the camel-like *Maceranchenia*, the rhinoceros-like *Toxodon*, and other strange extinct animals which evolved in South America during the Age of Mammals, when it was an island continent, as Australia is to-day. Here too, is the great sabre-tooth tiger, one of the host of northern animals that invaded the southern continent upon its union with the northern world, and swept before them to extinction most of its ancient inhabitants.

The principal exhibits on the north side of the hall are the mammoths and mastodons and the series of skulls showing the evolution of the elephants. The "Warren Mastodon" is a classic specimen. It was found near Newburg, N. Y. in 1846, and is the finest specimen of its kind that has ever been discovered. There is some confusion in the mind of the layman between the mammoth and mastodon; in a general way they are both elephants, the main distinction

Fossil
Mammals of
South
America

Warren
Mastodon



Tooth of Mastodon and Mammoth

between them being in the character of the teeth. While modern elephants are confined to portions of Asia and Africa, fossil remains of elephants and mastodons show that at one time or another in the past, they were found over the greater part of the northern hemisphere.

Skeletons of the Asiatic and African elephants are shown for comparison with their extinct relatives and among these, is the once famous Jumbo, whose name has been embodied in the English language as a term for anything unusually large.

[See *Handbook No. 4, Animals of the Past.*]

SOUTHEAST WING

FOSSIL MAMMALS OF THE TERTIARY PERIOD

Return to the East Corridor and continue into the *Southeast Wing* or Tertiary Hall which contains the Fossil Mammals of the Tertiary Period.

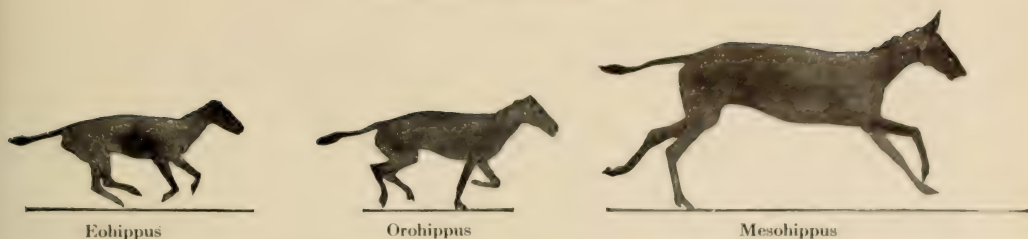
The geological age to which all the fossils shown in this hall belong, covers a period of from 100,000 to 3,000,000 years. At each side of the entrance are charts indicating the successive periods of time from the Triassic to the Tertiary, and the animal life which pertained to each. Careful guides and exhaustive cards of explanation, photographs, and window transparencies combine to make the entire exhibit illuminative and interesting.



Restoration of *Eohippus*, the four-toed horse. This ancestor of the modern horse, scarcely larger than the red fox, lived some three millions of years ago. It comes from the Lower Eocene of Wyoming and New Mexico

The particular feature of this hall is the wonderful series in the cases by the entrance and in the first alcoves on the right showing the evolution of the horse in nature. The Museum is justly proud of this collection. Not only is it the largest and finest series of fossil horse skeletons in the world, but it is larger than the combined collections of all other institutions, and it contains the earliest known ancestors of the horse, the little four-toed *Eohippus*, which was no bigger than a fox and on four toes scampered over Tertiary rocks. As will be seen by an examination of the skeletons of the horse and man in the Quaternary Hall, the modern horse walks on the tip of his middle finger and toe. The front hoof bone corresponds to the last joint of the third finger in the human hand, and the other bones of the leg correspond bone for bone with the structure of the finger, wrist and arm of man. In the modern horse the remaining fingers or toes of the fore and hind foot

Evolution
of the
Horse



have entirely disappeared, or remain only as vestiges, the so-called "splint bones." The structure of the modern horse shows that it developed from a five-toed ancestor. This ancestry has been traced back to the four-toed stage. [See *Guide Leaflet No. 36. The Evolution of the Horse.*]

In the wall case at the right of the entrance is given a synopsis of the evolution of the foot and skull of the horse and the geological age in which each stage is found. Across the alcove the visitor will find the skeleton of *Eohippus*, the four-toed stage of the horse and the earliest form that has been discovered. This specimen is from the Wind River beds of Wyoming and may have lived 3,000,000 years ago. It is interesting to note that while there were no horses found in this country by the white settlers, America is the original home of the horse.

Passing from skeleton to skeleton the changes that have taken place in the development of the horse are easily distinguished. The exhibit is made more lifelike by plaster restorations of the animals and by water-color sketches showing primitive horses in their environment. These paintings and models are by Charles R. Knight. In the later types of the three-toed stage the two lateral toes have lost their original function of support and are gradually becoming vestiges. The three-toed horse in the center of the alcove is one of the most complete and finest examples that has ever been unearthed.

Opposite the horse exhibit on the other side of the hall, are series of specimens illustrating the evolution of the camel, deer and other cloven-hoofed animals. These animals like the cow of to-day walked on the tips of the third and fourth fingers, and the gradual disappearance or reduction to useless vestiges of the other fingers and toes can be traced as in the horse series.

The large blocks showing groups of skeletons of early camels, skulls and bones of primitive ruminants in their natural position in the rock, show how these specimens are sometimes found and raise questions as to how they got there, more easily asked than answered. The giant pigs, or elotheres, and the pigmy hippopotamus will repay examination.

The primitive rhinoceros-like animals are shown near the center of the hall on the right. It seems hard to believe that our vast western country and indeed all North America, was

Camels

Giant Pigs

and Pigmy

Hippopotamus

Rhinoceros

THE EVOLUTION OF THE HORSE.

		Formations in Western United States and Characteristic Type of Horse in Each				Fore Foot	Hind Foot	Teeth
Quaternary or Age of Man	Recent Pleistocene	<p>SHERIDAN</p> <p>BLANCO</p> <p>LOUP FORK</p> <p>JOHN DAY</p> <p>WHITE RIVER</p> <p>UINTA</p> <p>BRIDGER</p> <p>WIND RIVER</p> <p>WASATCH</p> <p>PUERCO AND TORREJON</p> <p>Equus</p> <p>Prototippus</p> <p>Mesotippus</p> <p>Protorotippus</p> <p>Hyracotherium (Eotippus)</p>				One Toe Splints of 2 nd and 4 th digits	One Toe Splints of 2 nd and 4 th digits	
	Pliocene					Three Toes Side toes not touching the ground	Three Toes Side toes not touching the ground	
Tertiary or Age of Mammals	Miocene					Three Toes Side toes touching the ground; splint of 5 th digit	Three Toes Side toes touching the ground	
	Oligocene					Four Toes		
	Eocene					Four Toes Splint of 1 st digit	Three Toes Splint of 5 th digit.	
Age of Reptiles	Cretaceous Jurassic Triassic	Hypothetical Ancestors with Five Toes on Each Foot and Teeth like those of Monkeys etc.						

The history of the evolution of the horse through the Age of Mammals gives the best example in existence of the doctrine of evolution by means of natural selection and the adaptation of a race of animals to its environment. During three millions of years these animals passed through important changes especially in the teeth and feet, adapting them more and more perfectly to their particular environment, namely open plains with scanty stunted herbage. This may be had in post-card form.

once the home of the rhinoceros. As here indicated great herds roamed over the fields in the Tertiary Period and their fossil remains are found imbedded in the sandstones and clays of the badland formations. Opposite these are shown the ancestors of the dogs, cats and other carnivores and the Creodonts or Primitive Carnivores of the early Tertiary. Next to these are the small mammals — the insectivores, rodents and marsupials; and the fossil lemurs and monkeys, fragmentary but interesting because of their bearing on the ancestry of man.

On the south side on the right are skeletons of titanotheres, on the left of uintatheres, huge extinct, horned animals peculiar to North America.



Restoration of *Brontosaurus*. One of the largest of the amphibious dinosaurs, cold-blooded, slow-moving, unintelligent creatures that grew to large size (65 ft. in length) in the rich vegetation of the Reptilian era

SOUTHEAST PAVILION

FOSSIL REPTILES AND FISHES

The visitor now enters the *Southeast Pavilion* containing the dinosaurs and other fossil reptiles and also fishes. These animals belong to a more ancient period than the specimens just examined. They lived from 3,000,000 to 10,000,000 years ago. They include the well-

**The Dinosaur
Diplodocus**

known dinosaurs of which the Museum has a large collection. In the wall case on the left is a portion of the skeleton of the dinosaur *Diplodocus*; this was the first of these speci-

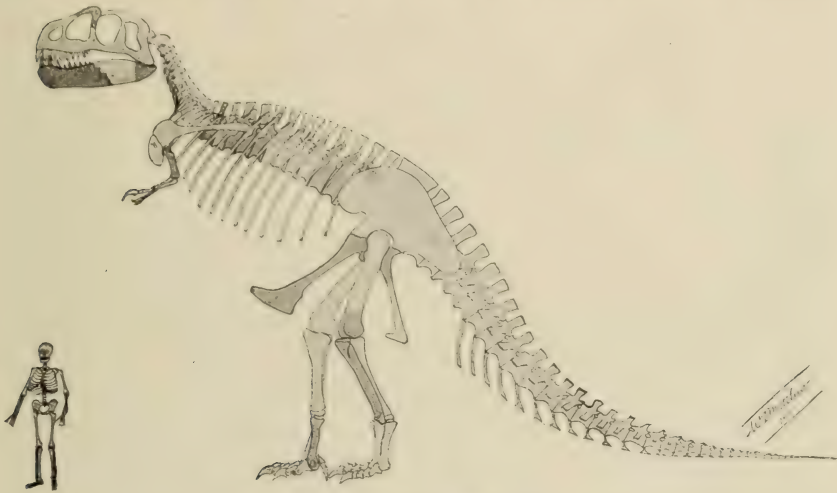


TRACHODONS OR DUCK-BILLED DINOSAURS

Fossil reptiles, fifteen to sixteen feet high and thirty feet long, with spreading webbed feet, compressed tail and duck-like bill, all of which indicate a more or less aquatic existence

mens to be unearthed by the Museum, while on the right is a nearly complete skeleton of a related species mounted as it lay when ten million years ago it settled to the bottom of a western lake where it was gradually covered with sand and mud and slowly turned into stone.

The gigantic skeleton in the center of the hall is the huge extinct reptile, the dinosaur *Brontosaurus*, found in the Jurassic beds of Wyoming. It is the only mounted specimen of its kind in the world and more than two-thirds of the skeleton is the original petrified bone. It is sixty-six feet eight inches in length, sixteen feet in height and is estimated to have weighed when alive thirty-five tons. Bronto-



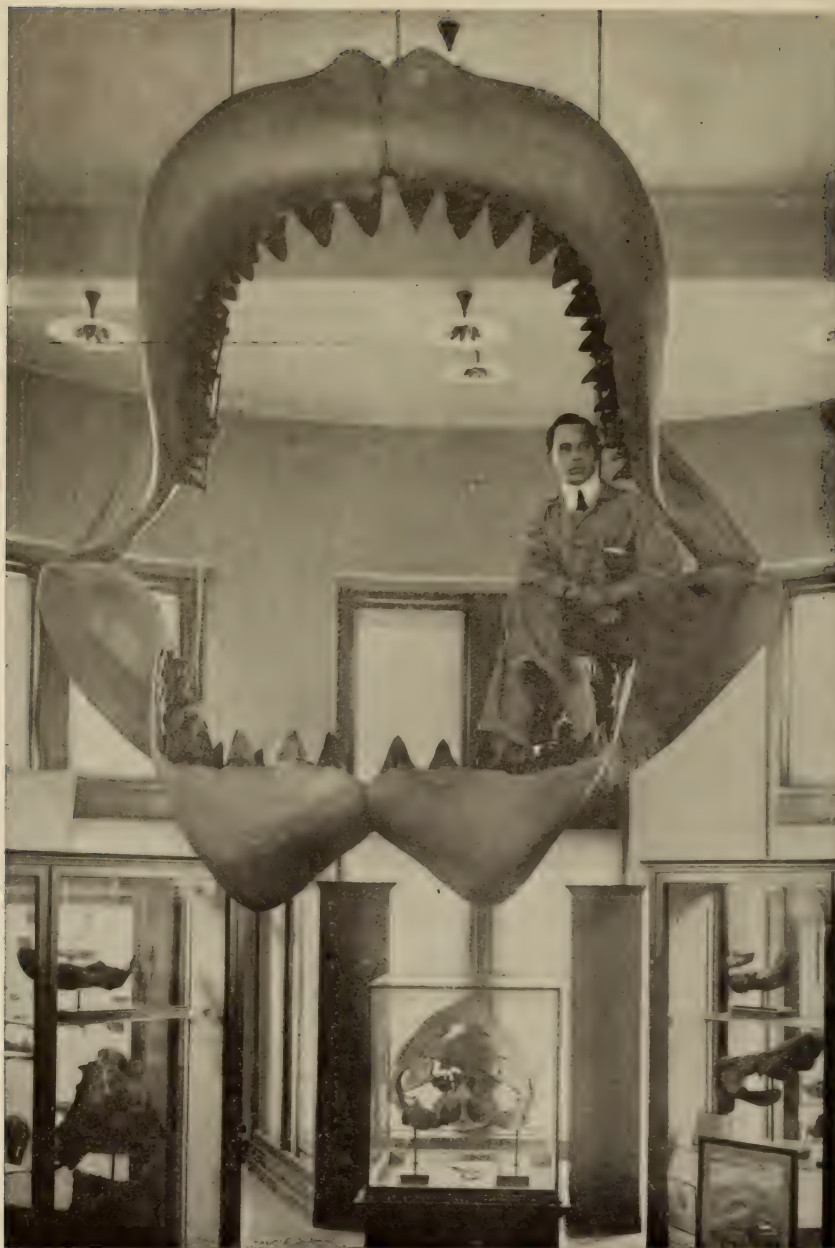
TYRANNOSAURUS AND MAN

A man would have been but a mouthful for this the latest and largest of flesh-eating dinosaur. Skeletons of two of these monsters are now being mounted for exhibition.

saurus is one of the largest giant reptiles and as is indicated by its teeth was herbivorous, probably living on the rank water weeds of the nearly sea-level marshes of Wyoming. Contrasted with the herbivorous Brontosaurus, is the carnivorous dinosaur *Allosaurus*, mounted to represent the animal feeding on the fallen carcass of a Brontosaurus, upon which it preyed. This is not a fanciful mounting for these very skeletons were found in close proximity to each other in the Jurassic beds of Wyoming, and the skeleton of the fallen Brontosaurus shows gouges made by the teeth of Allosaurus as it tore the flesh from its victim.

Near the Allosaurus group is a portion of a skeleton of *Tyrannosaurus* the last and most powerful of the carnivorous dinosaurs. Like Allosaurus it has enormous three-toed hind legs, armed with sharp claws, and smaller forelegs. *Tyrannosaurus* is from Montana and the matrix in which it was found is as hard as flint.

**Tyranno-
saurus**



RESTORATION OF THE JAWS OF A FOSSIL SHARK

This largest and most formidable fish, living or extinct, of which we have any record frequented the Coast of South Carolina in Tertiary time. The jaws measure nine feet across; estimated length of fish, eighty feet, as large as a sulphur-bottom whale

To the left of *Brontosaurus* are two complete specimens of the duck-billed dinosaur *Trachodon*. One shows the animal erect and standing on guard, while the other is shown feeding on shellfish and plants of the Cretaceous swamps of Montana.

Trachodon Most wonderful, perhaps of all the specimens shown
Mummied here is a "mummy" of *Trachodon* in which the texture
Dinosaur of the skin is preserved.

The animal is lying on its back and, in spite of its crushed condition, its form is easily distinguishable. It probably died on a sand bank or near a shoal where the hot winds dried up the flesh until the skin adhered to the bones like a close-fitting glove, and was subsequently buried by a flood.



Section of the skin of *Trachodon* showing the small scutes with which the animal was covered. About natural size

Other specimens shown in the hall include the smaller carnivorous dinosaurs, the horned dinosaurs with, in one instance at least, a skull seven feet in length, and giant birds possessed of teeth. There is also the finback lizard, one of the most ancient of fossil reptiles; *Diadectes*, a reptile with a solid-boned skull and *Eryops*, a primitive amphibian. The finest collection of fossil turtles in the world will be found on the south side of the hall.

In the *Tower* of the Southeast Pavilion are displayed the fossil fishes which belong to a much earlier period than the mammals and reptiles, some of them having lived twenty to fifty millions of years ago. Many of these forerunners of back-boned animals are quite unlike any living fishes and are probably only very indirectly related to them; some were small, curiously encased in shells;

Fossil Fishes

others, shown in the three cases in front of the visitor, attained large size and were evidently formidable creatures. One of them in fact, *Dinichthys*, shown in the middle of the gallery, was probably among the most destructive creatures that ever lived in the sea. Its jaws were so strong that it could crush a plate of bone as thick as one's hand. Such an actual specimen, fractured in life and showing the marks of "teeth" is shown in a neighboring case.



RESTORATION OF NAOSAURUS

One of Nature's jokes. Professor Cope, who was also a joker, suggested that the high fin served as a sail, by means of which Naosaurus sailed over the lakes near which it lived

The collection is so arranged that he who makes the tour can see the principal kinds of fossil fishes and is able, in a measure, to outline the history and pedigree of the entire group. He can trace the rise and fall of the early plate-covered fishes; the era of the sharks which on the one hand supplanted the earliest fishes and were in time replaced by the more efficient lungfishes and ganoids; the age of ganoids when the waters were filled with these enamel-scaled fishes; finally the age of the bony-fishes, or teleosts, the multitudinous forms of to-day, the herrings, cods, perches, whose methods of swimming, feeding and breeding are far more efficient than those of any of their predecessors.

Above the entrance are the jaws (models), spreading nine feet, of a huge fossil shark in which the actual teeth are arranged as in the sharks of to-day, in the usual banks or rows — the teeth in the hinder rows serving to replace those in front, nature having dealt more kindly in the matter of teeth with sharks than with man. Such a shark probably measured from seventy to ninety feet and its race may well have become extinct, when for various

Jaws of
Giant Fossil
Shark

reasons the enormous volume of food necessary to support it could not be maintained within its range of sea.

Fossil Aquarium In the first alcove to the left, by the window, is a "fossil aquarium" in which a number of models of these earliest fishes are arranged in a group, as though alive in the sea.

Sharks In the next alcove are the early fossil sharks which superseded the tribe of plated fishes just mentioned. These sharks had soft skeletons, simple fins and a number of other primitive features which lead to the belief that all of the higher fishes, and the higher back-boned animals therefore as well, were descended from them, their simpler structures becoming more complicated in many directions. In one of the early sharks here exhibited, impressions of soft parts such as muscles and gill filaments have been preserved.

Chimæroids In the third alcove appear rare fossils of silver sharks or Chimæroids, which appear to have been developed from a primitive race of sharks. Curiously enough fossil egg capsules of these forms are sometimes preserved, and examples are here present. In neighboring cases are shown ancient lungfishes and ganoids — groups from which all land-living quadrupeds are believed to be descended.

Ganoids In the fourth alcove are shown the ganoid fishes which dominated the waters during the Age of Reptiles. They were of many kinds and sizes, most of them with lozenge-shaped scales of bone, with enamelled surface. One of the few survivors (*Amia*) of this ancient group is here shown living (in a window aquarium), to give the visitor a clearer idea of the fishes of the "Middle Ages" of the world.

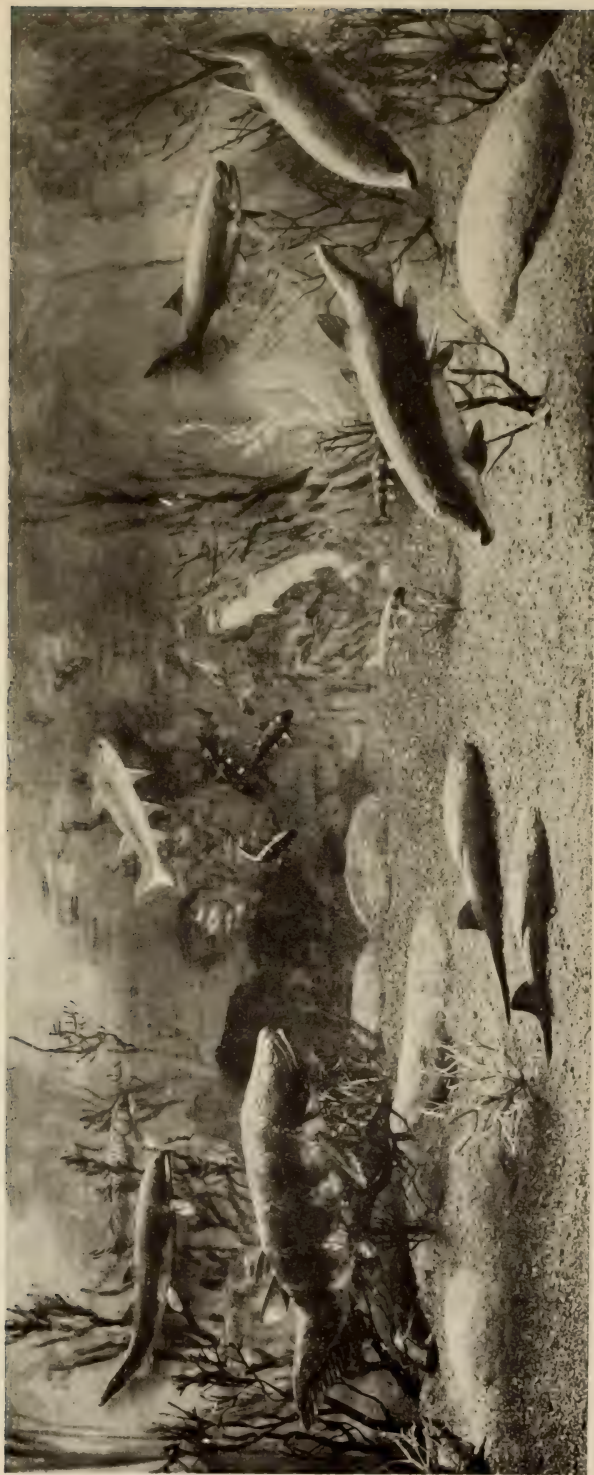
Teleosts In the fifth alcove are the petrified fishes of the Age of Mammals. By this time nearly all of the primitive fishes, like sharks, lungfishes and ganoids, had become extinct; and the common forms were bony-fishes, or teleosts, closely related to our herrings, perches, mackerels and daces.

[Return to the South Pavilion or Hall of Mastodons and Mammoths.]

SOUTH CENTRAL WING

GEOLOGY AND INVERTEBRATE PALÆONTOLOGY

Turning northward at the center of the Quaternary Hall containing the mastodons and mammoths, the visitor enters the *South Central Wing* of the building and is in the Hall of Geology and Invertebrate Palæontology. Owing to important changes in progress in the arrangement of this hall, but a portion of the collections are at present on exhibition, though all are available for study.



THE "FOSSIL AQUARIUM" IN THE FISH GALLERY

This shows what can be done to make these ancient forms appear as living. The group illustrates the typical "Age of Fishes," Devonian, in which the forms came from a single locality (Cromarty) and a single rock layer in the Old Red Sandstone of Scotland. The seaweed is also a restoration, modeled from impressions of the same age. Cromarty is noteworthy, not merely for its deposits of Fossil Fishes, but for being the birthplace of Hugh Miller whose discoveries and descriptions did so much to make the fishes known alike to the scientific world and the general public.

At the entrance of the hall is the general collection of meteorites, which is one of the largest and most representative in this country, containing as it does specimens from about five hundred of the seven hundred falls and finds that are known throughout the world. Some of the principal features of our collection are:

Two thousand or more individual masses from the "stone shower" that fell near Holbrook, Arizona, in 1912. These have been arranged in a case by themselves in the middle of the collection.

The whole mass of Ysleta, a newly discovered (1914) iron meteorite, weighing 310 pounds from near the ancient village of Ysleta, New Mexico.

A series of polished and etched large slices of iron meteorites, including an entire section of the new Mt. Edith, Australia, mass, showing the Widmanstätten lines in great perfection, and polished slabs from several large stone meteorites. These are in a case by themselves which likewise contains several comparatively large entire single masses of some famous falls.

An exhibit of meteoritic masses, decomposition products, and country rock showing unaltered material and that which was melted and otherwise altered by the impact of the Canyon Diablo meteorite at the spot now known as Meteor Crater, Arizona. This exhibit has been loaned to the Museum by Princeton University.

The desk case in the first alcove to the left as one enters the hall contains a series of rock specimens showing the geology of Manhattan Island. This is arranged geographically and illustrates all the most prominent features of immediately local geology from south to north.

Going northward in the hall the next large exhibit to attract the attention of the visitor is the stump and part of the roots of a large tree from an anthracite coal mine under Scranton, Pa. Millions of years ago, in the geological period known as the Carboniferous, this tree grew upon the top of a thick swamp deposit of decaying vegetation which ultimately became a most valuable bed of coal. The stump was left in the roof of the mine when the coal was extracted for commercial and domestic uses. It fell to the floor years after the gallery had been abandoned and was discovered only through the chance visit of a miner.

Next the visitor will see an exhibit illustrating some of the results of an expedition which the Museum sent to Martinique and St. Vincent during the great volcanic eruptions of 1902-1903 that devastated those islands of the Lesser Antilles chain. A set of four relief maps shows the island of Martinique and its famous volcano, Mont Pelée, at three important stages of the eruptions, while the nearby cases and pedestals contain relics of the ruined city of St. Pierre and the dust, stones and bread-crust bombs that were thrown out in a white hot or molten condition

by this volcano and by the Soufrière of St. Vincent. Nearly 30,000 people were killed by these outbreaks. Important geological facts were learned from the observation and subsequent study of the series of events.

An attractive case is that containing some marvelously beautiful specimens of calcite, aragonite and gypsum from the famous Chihuahua silver-and-lead mines near Santa Eulalia in the vicinity of Chihuahua, Mexico. These specimens are remarkable for the perfection of their crystalline form or the delicacy of their fibrous developments and for their colors.

The northeastern corner of the hall is devoted to the Copper Queen Mine Model and a series of ores and other specimens from the famous Bisbee-Warren copper district in southern Arizona. Two models have been prepared as a result of several years of extremely painstaking and skillful work. A large model, some 18 by 12 feet in dimensions shows on a scale of twenty-four feet to the inch all the surface features and mine and other buildings over four of the principal mines (Holbrook, Spray, Gardner and Lowell) belonging to the Copper Queen Consolidated Mining Company, while a painted background represents the surrounding mountains and the town of Bisbee. The sides of the model give vertical sections to a depth of about 1200 feet illustrating the geology of the area and showing the general manner of getting out the ore and hunting for new deposits. There have been produced in about 30 years (1880-1912) from the mines at Bisbee belonging to this company 7,729,922 tons of copper ore of an average copper content of 7.16%. The metal production in this period was

Copper — 1,106,605,774 pounds (553,303 tons)
 Gold — 104,775 ounces Troy (8,731 pounds)
 Silver — 6,107,421 ounces Troy (508,952 pounds).

Near the large general model there has been installed a small model on a scale of six feet to the inch showing the usual methods of extracting the ore by "stoping." Drilling, picking, timbering, filling old cavities, transporting, raising ore to the surface and other operations are illustrated as well as is practicable on the scale adopted. The shaft is equipped with its cages, which are arranged so that they go up and down by means of automatic machinery.

Specimens of ore, minerals and rocks from the mine and the adjacent country illustrate the geology of the region. Chief of these specimens are velvet malachites that were taken from the original "Queen" mine, the Open Cut, in the early eighty's and a great block of malachite and azurite weighing about four tons taken from the Mine in 1892 and exhibited in the Arizona mining exhibit at the Columbian Exposition in 1893. Enlarged photographic transparencies give details of scenery and mining, supple-

menting what is shown by the models. The work of treating the ores at the smelter in Douglas near Bisbee is demonstrated in a neighboring case.

The northwest corner of the hall contains a display of caves and cave material the most important feature of which is the reproduction of part of a beautiful cave that was discovered early in 1910 in mining operations at the Copper Queen mine. The cave was formed by the dissolving action of water traversing joints in limestone, and its walls, roof and bottom were afterward coated with calcite (calc spar) incrustations, stalactites and stalagmites, some of which are dazzling white while others are colored green with copper salts or pink with manganese compounds.

Alongside the Copper Queen cave a reproduction of a chamber in Weyer's Cave, Virginia, is being installed. Weyer's Cave is in a region of much heavier rainfall than Bisbee, which is probably the principal factor in producing a greater wealth of regular stalactite and stalagmite growth than adorns the Copper Queen cave.

The cases along both sides and down the middle of the hall contain geological and palæontological specimens. Palæontology is the science of the ancient life of the earth; its field is the study of the fossilized shells and other hard parts and the various kinds of imprints left by the animals formerly inhabiting the seas and lands, and preserved in deposits which now form our stratified rocks. As normally the upper layers of a series of strata are more recent than the lower, the fossils reveal the succession of life forms in the earth's crust and thus are of the highest value and interest to the student of historical geology. Since, however, the remains of only a small proportion of the animals living at a given period are permanently preserved in the marine, river, lake and subærial deposits of that period, the geological record of animal and plant forms is far from complete. Inasmuch as invertebrate animals are far less free in their movements than the vertebrate forms, they are accepted as the best determinants of the geological age of a bed of rock, even when remains of both kinds are found together. Invertebrate life, too, appeared on the globe far earlier than vertebrate, and remains of certain species are abundant in the lowest (oldest) of our stratified rocks.

The specimens in the cases on the west side of the hall are being arranged to illustrate historical geology, beginning at the south (entrance) with the Archean rocks, which are the lowest and oldest of all and contain no fossils, advancing regularly through the Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Jurassic, Triassic, Cretaceous and Tertiary. Most of the specimens on exhibition are from American localities, but a synoptic series of European fossils is exhibited in the northwest quarter of the hall. The desk cases in the middle of the hall contain overflow material from the sides. Under

Historical Geology

the historical sub-division the species are arranged according to their position in the scale of life — that is, following a biological classification, the lower or simpler forms being placed first. The diamond-shaped bits of emerald green paper attached to some of the specimens indicate those, more than 8,000 in number, known as “types” or “figured specimens,” used by James Hall, R. P. Whitfield and others in the original description and naming of species or in their elucidation.

The upper shelves and the ends of the upright cases contain particularly large or striking specimens of fossils, or blocks of rock illustrating the geological features of the horizons in which the fossils occur.

Attention may be called also to the collection of Michigan copper ores, orbicular granites and diorites from several parts of the world, fossil crinoids from Waldron and Crawfordsville, Indiana, fossil corals from the Devonian reefs near Louisville, Kentucky, fossil crinoids and an immense clamlike shell from the Cretaceous of Nebraska, fossil plants from Tertiary beds at Florissant, Colorado. The windows contain some colored transparencies from photographs of interesting scenery in the West.

[Return to the Hall of Mastodons and Mammoths and turning to the right enter the West Corridor or Gem Hall.]



CRYSTAL BALL IN THE MORGAN COLLECTION

WEST CORRIDOR

GEMS AND PRECIOUS STONES

Gems and Precious Stones

The West Corridor contains the Morgan gem collection. This valuable series of gems and precious stones was presented to the Museum by Mr. J. Pierpont Morgan, one of the founders and a trustee of the institution. It comprises a representative assemblage of cut and uncut gems, many of the former of remarkable size and some of great purity of color. The installation aims to bring into juxtaposition, the cut and uncut material, the former is arranged around the latter, in the center of the cases, and the visitor may thus observe the brilliancy of effect produced in the natural mineral by skillful artificial treatment (cutting).



A PORTION OF THE GEM HALL

In the wall cases are many fine examples of quartz, calcite, malachite, azurite and amethyst. In the desk cases are cut and uncut diamonds, sapphires, topaz and other gems. The collection, presented to the Museum by the late Mr. J. Pierpont Morgan, includes many large and rare forms which could not be duplicated

A partial gradation in importance and value is obtained by the arrangement of the gems, beginning with Diamond at the extreme south and passing north, case by case (through Corundum (*Sapphire*), Beryl, (*Emerald*), Topaz, Tourmaline, Chrysolite, Spinel, Zircon (*Hyacinth*), Chrysolite (*Peridot*), Adularia (*Moonstone*), Opal, Amethyst, Kunzite, Amber, Pearls.) In one case a varied collection of semi precious or ornamental stones is shown, many of which are experimental efforts to use mineral material which can never have any very extended use, viz., prehnite, titanite, sphalerite, hematite, cyanite, etc., etc.

Handsome wall case specimens of large size line the sides of the Gem room, among which the Azurite, Malachite, Quartz, Amethyst, Gypsum and Tourmaline are pre-eminent for size or beauty.

SOUTHWEST WING

MINERALS

Next beyond the Gem Hall is the *Southwest Wing* or Hall of Minerals. At the entrance to the hall is a case in which recent acquisitions are placed.

**Bement
Collection
of Minerals** The general collection of minerals consists chiefly of the well-known Bement Collection which contains specimens representing species of the known minerals of the world. Not only is the collection noted for its numbers, but in many instances the beauty and size of the individual specimens are quite unsurpassed in other collections.

The more attractive specimens are displayed in cases arranged down the center of the room. The remainder of the collection is arranged according to the classification of minerals. In the first cases on the right or left are models of the six systems of crystals and other introductory illustrations of the physical and optical properties of minerals. Each mineral has a characteristic form of crystallization which is one of the means of identifying it. The distribution of the more important minerals is indicated on maps.

SOUTHWEST PAVILION

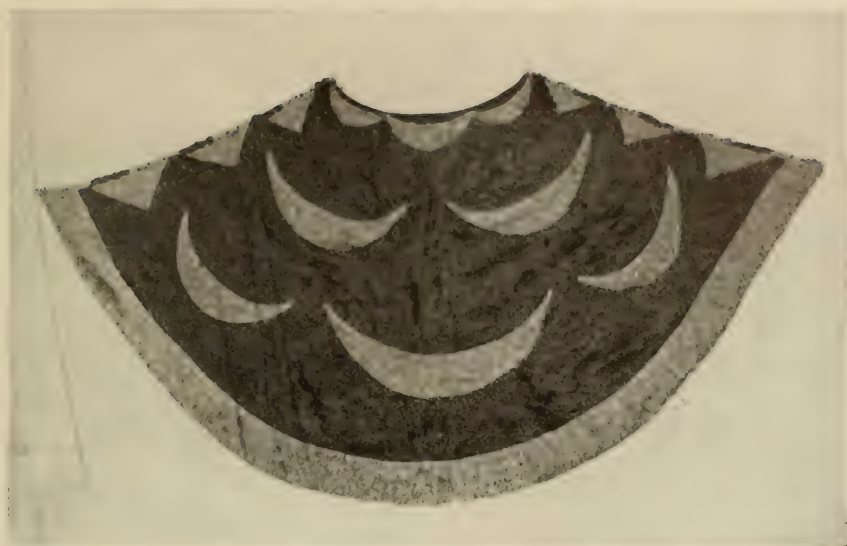
COLLECTIONS FROM THE PACIFIC ISLANDS

Entering the *Southwest Pavilion* beyond the Hall of Minerals the visitor will find specimens pertaining to the natives of the Pacific Islands. The wall cases contain examples of war implements, tapa or bark cloth, sacred masks, boomerangs and armor.



TAHITIAN FIRE-WALKER

In the fire-walking ceremony the priest and his followers walk barefoot over a row of heated boulders of basalt



HAWAIIAN FEATHER CLOAK

The central figure in this hall is a Tahitian priest represented as taking part in the fire-walking ceremony, in which the participants walk over heated boulders of lava. On either side are groups engaged in grating cocoanut, making kava, weaving mats for houses.

**Tahitian
Fire-walker**

In the box case behind the Tahitian fire-walker there is exhibited a striking series of Melanesian masks, a few fashioned from the facial portion of human skulls, the majority carved of wood. These masks are worn by dancers during festivals in honor of the dead. Near the window there is a case of sacred Melanesian carvings topped by a totem pole that bears a superficial resemblance to the totem poles of the North Pacific coast of America.

The cases in the center contain kava bowls, head rests, shell and ebony armlets and other ornaments, betel spatulas, ceremonial paddles, hats, mats and baskets. These people follow the custom of tattooing themselves. Their occupations as here detailed are peaceful rather than warlike. The swinging picture-frames on the left of the entrance midway down the room give some idea of the dress, customs, and pastimes of the South Sea Islanders.

A noteworthy object is the cloak from the Hawaiian Islands, made of red and yellow feathers. Such cloaks were worn by chiefs — and as each bird furnished but few feathers and, considering the value put upon them and the time required for making a cloak, the one shown represents a very high value.

Feather Cape

The entrance to the Maori Tower is flanked by two wall-cases with



GENERAL VIEW OF THE PHILIPPINE HALL

Australian material. There is a good series of boomerangs, and the very crude stone tools and weapons of the Australians are well represented.

The great boulder of jade, from New Zealand, supports the figure of a Maori warrior in an attitude of defiance, and in the room at his back is a fine series of dried, tattooed heads, gruesome relics of the time when Maori warriors preserved the heads of their vanquished enemies.

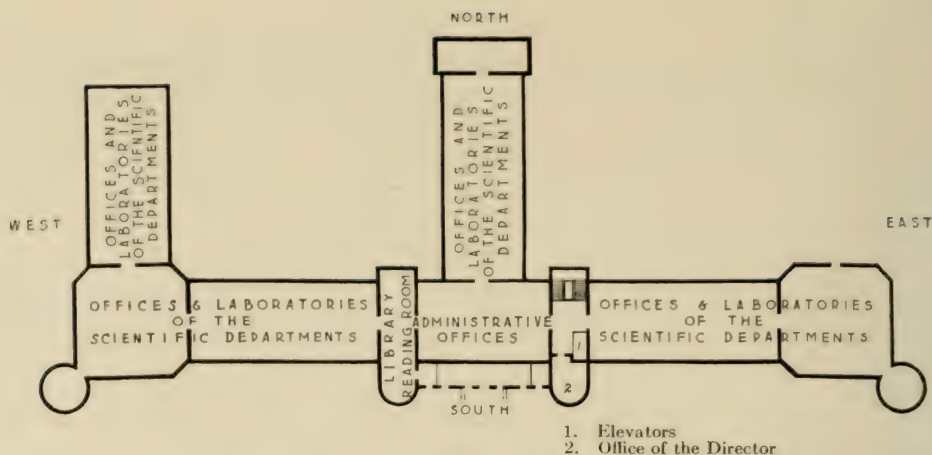
WEST WING

COLLECTIONS FROM THE PHILIPPINES

The hall due north beyond the Hall of the Pacific Islands is devoted to a collection from the Philippine Islands. The installation here, as in the African hall, is geographical. The specimens of wood along the walls are Philippine woods. The palm leaf mats above the windows around the hall are in some cases very beautiful. The brasswork, boar-bristle tooth brushes, necklaces, shell bracelets, knives, spears, bead-ornamented combs, medicines, guitars, horse accoutrements evidence superior workmanship. These people present a higher civilization than their South Sea Island neighbors. The exhibit of clothing distinctive of each tribe is very complete. The model at the entrance depicts a woman weaving a garment similar to some of those seen in the cases. The house in the tree at the end of the room, a life-size copy of a tree-house such as the Lake Lanao Moros build, will remind many visitors of the Swiss Family Robinson.

**Living Tribes
of the
Philippine
Islands**

[Return to the elevators.]



FIFTH FLOOR

The fifth floor is given over to the administrative offices, the offices and laboratories of the scientific departments and the library which contains some 70,000 volumes on natural history, anthropology and travel.

The reading room of the library is located in the west corridor and, with the exception of Sundays and holidays, is open free daily, from 9 A. M. to 5 P. M., to all who may wish to consult the books. Besides the current issues of the more important periodicals, it contains the more general works of reference, while other volumes will, upon application to the librarian, be furnished to those who wish to consult them.

On this floor, too, are the workrooms of the Department of Vertebrate Palæontology, where the skeletons of fossil animals are prepared and mounted, and the laboratory where are made the beautiful models of invertebrates.

These, like the other laboratories, are of necessity not open to the public.

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POPULAR PUBLICATIONS

OF THE

AMERICAN MUSEUM OF NATURAL HISTORY

HANDBOOKS

These deal with subjects illustrated by the collections rather than with the objects themselves.

- No. 1.—NORTH AMERICAN INDIANS OF THE PLAINS. By CLARK WISSLER, Ph.D., Curator of Anthropology. October, 1912, 145 pages, maps and illustrations. *Paper, 25 cents; cloth, 50 cents.*
This gives an account of the Material Culture, Social Organization, Religion, Ceremonies, Arts and Languages of the Plains Indians of North America.
- No. 2.—INDIANS OF THE SOUTHWEST. By PLINY EARLE GODDARD, Ph.D., Curator of Ethnology. March, 1913, 190 pages, maps and many illustrations. *Paper, 25 cents; cloth, 50 cents.*
A résumé of our present knowledge of these interesting Indians. Among the subjects treated are the Spanish Conquest, Cliff Dwellings, Native Weaving, the Potter's Art and the Hopi Snake-Dance.
- No. 3.—THE ANCIENT PEOPLES OF MEXICO AND CENTRAL AMERICA. By HERBERT J. SPINDEN, Ph.D., Assistant Curator, Department of Anthropology. In preparation.
- No. 4.—ANIMALS OF THE PAST. A popular account of some of the Creatures of the Ancient World. By FREDERIC A. LUCAS, Sc.D., Director of the Museum. 250 pages with 41 illustrations by Charles R. Knight and Joseph Gleeson. *Paper, 35 cents.*
This, now revised as one of the series of Museum Handbooks, tells of mammoth and mastodon, of the giants among birds, the sea lizards and the huge dinosaurs.

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These describe some exhibit, or series of exhibits, of special interest or importance, or may deal with the contents of an entire hall.

Many of the earlier leaflets are out of print, but new editions of those most in demand are in course of preparation.

THE COLLECTION OF MINERALS. By LOUIS P. GRATACAP, A.M., Curator of Mineralogy. February, 1902. *Price, 5 cents.*

The minerals have been moved since this leaflet was issued, but it contains much information about the collection and a number of figures of interesting specimens.

NORTH AMERICAN RUMINANTS. By J. A. ALLEN, Ph.D., Curator of Mammalogy and Ornithology. *Revised edition*, February, 1904. *Price, 10 cents.*

Describes the rapidly disappearing large game of North America, such as the Bison, Elk and Mountain Sheep.

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By GEORGE H. PEPPER, Assistant in Anthropology. April, 1902. *Second edition*, May, 1909. *Price, 10 cents.*

PRIMITIVE ART. July, 1904. *Price, 15 cents.*

THE BATRACHIANS OF THE VICINITY OF NEW YORK CITY. By RAYMOND L. DITMARS, Curator of Reptiles, New York Zoölogical Park. October, 1905. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By FRANK M. CHAPMAN, Curator of Ornithology. April-July, 1906. *Price, 15 cents.*

PERUVIAN MUMMIES. By CHARLES W. MEAD, Assistant Curator, Department of Anthropology. March, 1907. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By EDMUND OTIS HOVEY, Ph.D., Curator, Department of Geology and Invertebrate Palæontology. December, 1907. *Price, 10 cents.*

The collection, which represents about 500 falls, numbering some 2,000 specimens, includes the great "Ahnighito" meteorite, weighing 36½ tons, brought from Greenland by Peary, the strange "Willamette" meteorite and the "Canyon Diablo" which contains minute diamonds.

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By FRANK M. CHAPMAN, Curator of Ornithology. February, 1909. *Price, 15 cents.*

These celebrated groups are designed to illustrate not only the habits but also the haunts, or habitats, of the species shown. The backgrounds are careful studies from nature and each represents some definite locality. Twenty-two of these groups are shown in this leaflet.

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By ALANSON SKINNER, Assistant Curator, Department of Anthropology. New Edition in Preparation.

BRIEF HISTORY OF ANTARCTIC EXPLORATION. March, 1910. *Price, 10 cents.*

A summary of the Exploration of Antarctic Regions, from the voyage of Captain Cook in 1768-1777 down to Shackleton's expedition in 1908.

TREES AND FORESTRY. By MARY CYNTHIA DICKERSON, B.S., Curator of Woods and Forestry. September, 1910. *Out of print. A new edition in course of preparation.*

This leaflet, based on the Jesup Collection of North American Woods, describes tree structure and growth, includes a key for the identification of trees in winter and considers forest industries and their management for profit.

No. 33.—THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By CHARLES-EDWARD AMORY WINSLOW, M.S., Curator, Department of Public Health. April, 1911, 25 pages, 13 illustrations. *Price, 10 cents.*

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No. 34.—PLANT FORMS IN WAX. By E. C. B. FASSETT. November, 1911. *Price, 10 cents.*

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Describes and figures natural size the common species (31 in all) of the eastern United States.

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REPRINTS

of Important Articles in the *American Museum Journal*.

THE GROUND SLOTH GROUP. By W. D. MATTHEW. April, 1911. Describes the structure and habits of these giant relatives of our sloths and anteaters. 8 pages, 4 illustrations. *Price, 5 cents.*

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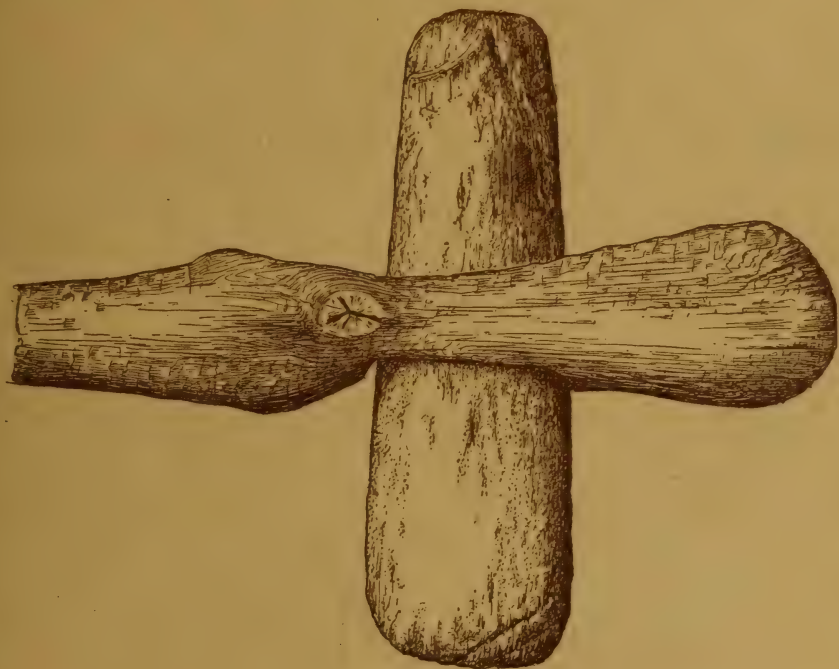


AMERICAN MUSEUM OF NATURAL HISTORY

FOR THE PEOPLE
FOR EDUCATION
FOR SCIENCE

AMERICAN MUSEUM OF NATURAL HISTORY

THE INDIANS OF MANHATTAN ISLAND AND VICINITY



BY ALANSON SKINNER

GUIDE LEAFLET SERIES No. 41

THIRD EDITION

POPULAR PUBLICATIONS
OF THE
AMERICAN MUSEUM OF NATURAL HISTORY

HANDBOOKS

These deal with subjects illustrated by the collections rather than with the objects themselves.

NORTH AMERICAN INDIANS OF THE PLAINS. By CLARK WISSLER, Ph.D., Curator of Anthropology. 2d edition, 1920. 164 pages, maps and illustrations, *Cloth, 75 cents.*

This gives an account of the Material Culture, Social Organization, Religion, Ceremonies, Arts and Languages of the Plains Indians of North America.

INDIANS OF THE SOUTHWEST. By PLINY EARLE GODDARD, Ph.D., Associate Curator, Department of Anthropology. New edition, 1920, 190 pages, maps and many illustrations. *Cloth, 75 cents.*

A resumé of our present knowledge of these interesting Indians. Among the subjects treated are the Spanish Conquest, Cliff Dwellings, Native Weaving, the Potter's Art and the Hopi Snake-dance.

ANIMALS OF THE PAST. A popular account of some of the Creatures of the Ancient World. By FREDERIC A. LUCAS, Sc.D., Director of the Museum. 250 pages with 41 illustrations by Charles R. Knight and Joseph Gleeson. *Paper, 50 cents.*

This, now revised as one of the series of Museum Handbooks, tells of mammoth and mastodon, of the giants among birds, the sea lizards and the huge dinosaurs.

PEOPLES OF THE PHILIPPINES. This presents essential facts as to the racial and cultural characters of the Philippine Islands population. 1919, 224 pages, maps and many illustrations. *Cloth, 75 cents.*

FISHES OF THE VICINITY OF NEW YORK CITY. By John Treadwell Nichols, with an introduction by William K. Gregory. August, 1918, 118 pages, many illustrations. *Cloth, 75 cents.*

ILLUSTRATED GUIDE LEAFLETS

These describe some exhibit, or series of exhibits, of special interest or importance, or may deal with the contents of an entire hall.

SOME OF THE LEAFLETS

NORTH AMERICAN RUMINANTS. By J. A. ALLEN, Ph.D., Curator of Mammalogy and Ornithology. *Revised edition, February, 1904. Price, 10 cents.*

Describes the rapidly disappearing large game of North America, such as the Bison, Elk and Mountain Sheep.



A MAHIKAN INDIAN CHIEF FROM THE HUDSON RIVER BELOW ALBANY

Note his war club, the shape of which is common in his region, the thunderbirds painted or tattooed on his face, and his belt embroidered with dyed deer's hair. His totem, the Tortoise, is at his feet. This man and the three Mohawk Chiefs shown following formed a party which visited England in 1709.

From an engraving in the possession of the New York Historical Society.

INDIANS OF MANHATTAN ISLAND AND VICINITY.

By Alanson Skinner,

Formerly of the
Department of Anthropology.

INTRODUCTION.

THERE is no subject which makes a more forceful appeal to the student, the historian, or even the general reader, than that of the native inhabitants of what is now Greater New York; yet there is no subject upon which it is more difficult to obtain information, for our Colonial ancestors have left us but few accounts of their observations, and these are in tomes that are rare and difficult of access.

The aborigines themselves have so nearly passed into oblivion, that no help can be obtained from their scattered and degenerate remnants in exile in the west, so that we must turn to two sources for our knowledge: the writings of the first white settlers, already mentioned, and the archaeological remains, the imperishable objects of stone, clay, bone and antler, which the vanished red men have left behind them on their ancient dwelling places.

The writings of the Colonists tell us that in appearance the Manhattan and their neighbors were tall and well-built, with black hair and eyes and not unpleasing faces. Their disposition is noted as mild, except when aroused, when they are said to have been very greedy of vengeance.

The men shaved their heads, or rather burned off their hair with hot stones, leaving often a standing roach of stiff black hair two or three inches high and as many broad, running from the forehead to the nape of the neck, and the lock which hung from the crown was generally allowed to grow much longer. This was the famous *scalplock*, which the warrior cultivated in defiance of the enemy, who might take it if he could. Sometimes they wore a roach of red dyed deer hair, exactly similar to those worn by the Sauk, Fox, Menomini, and other tribes of the Central West today. Our Indians *did not* wear the feather war-bonnet so characteristic of the Sioux and other tribes of the Great Plains, and which is now always placed upon the Indians in the conventional drawings picturing the sale of Manhattan Island.



A MOHAWK CHIEF FROM THE MOHAWK VALLEY

Observe his tattooing and his belt embroidered with dyed deer's hair. His totem, the Bear, is shown at his side.

From an engraving in the possession of the New York Historical Society.

The Manhattan and their neighbors, unlike the Indians west and north of them, wore no shirts or coats. Instead, they covered the upper parts of their bodies with robes made of dressed deerskin, or wolf, wildcat, or bear fur, or of the shimmering feathers of the wild turkey, neatly attached to a netted fabric. So closely and carefully were these feathers applied that they are said to have shed the rain.

The men also wore loin cloths or breechelouts of dressed leather, and leggings and moccasins of the same material. The moccasins of all the Indian tribes east of the Mississippi had one point in common, they were soft-soled, but west of the Mississippi region the tribes of the prairies used hard flat soles of rawhide for their shoes.

In addition to this costume, the warriors wore necklaces of dyed deer hair, of native copper or shell beads, or of wampum; and often they hung over their chests pendants of stone or gorgets, such as are still to be found occasionally upon the sites of their old camps. They also painted their faces with various pigments, especially red and black, which they obtained from limonite and graphite fragments. To this day one may find in the débris of an abandoned Indian village bits of these paint stones showing the striated markings of the stone scrapers with which the color was removed for use. The Manhattan, being a part of the Delaware tribe, an important group of the Algonkin stock, probably followed the ancient Delaware custom of tattooing their bodies, with designs representing their dreams and warlike exploits.

Old paintings of the Delaware show us that they wore their knives, and even their tobacco pipes and pouches, suspended from their necks. The reason for wearing their knives in this position, old Indians of some of the central western tribes declare, was so that they could be more readily seized at a moment's notice. Besides his deerskin tobacco pouch with its dyed hair and porcupine quill embroidery and leathern fringe, each warrior carried a war club, carved of wood, with a ball-shaped head set at right angles from the handle, and a six-foot bow and a quiver containing flint, bone, or antler-tipped arrows.

The women were differently clothed from the men. They often wore their hair in a braid, over which they drew a "square cap" ornamented with wampum. Presumably this hair dress was similar to that used by the Winnebago and Sauk and Fox women of the middle west today, examples of which may be found in the cases in the Woodland Hall under the various tribal designations.

The women, like the men, were naked to the waist, save for the robe, which was shifted to side to side, according to whence the coldest



His totem was the Wolf, which is shown beside him.
From an engraving in the possession of the New York Historical Society.

wind blew. They wore, however, knee leggings instead of the hip length style of the warriors, and wrapped about their waists a single square piece of fringed leather, which was open at one side. Sometimes these skirts were not made of leather, but instead were of cloth woven from Indian hemp, such as was also used to make bags. The women covered their gala costumes with wampum beads, and quill or hair embroidery, so that some of the old chroniclers declare that a dress of this sort was often worth "above 300 guilders." Of course the women, like the men, protected their feet with dainty soft-soled moccasins.

The houses or wigwams of the Manhattan and their neighbors were never the conical shaped, leather-covered, painted tipis so often shown in illustrations. Lodges of that type were found only in the Great Plains area, and northward up the Mackenzie River and thence eastward about Hudson Bay and Labrador. The Manhattan lodges were of bark, and they and the other local tribes commonly built either square or semi-globular houses of poles arched over and set in the ground, covered with bark, mats made of rushes, with corn husks, or sedge grass. Such houses looked very much like wooden bowls turned upside down. In the center of each wigwam a hole was dug in the earthen floor to hold the fire so that the sparks might not fly up and ignite the dry walls of the lodge.

In such fire holes, marking the sites of abandoned Indian houses, archaeologists may still find fire-cracked stones, wood ashes, the split bones of deer and other animals broken open to extract the marrow, oyster shells, fragments of earthen kettles, stone and bone implements, and all the discarded *débris* of the household utensils which were thrown away by their departed owners. Sometimes in such a place whole articles are found, hidden there perhaps during a sudden attack and never recovered by the owner. There too, in winter, when the frozen ground outside made digging impossible, the bodies of the dead were sometimes buried in the useful fireplace, and the lodge either destroyed or set up elsewhere. In proof of this skeletons have often been found in these forgotten fireplaces.

The interior furnishing of a round lodge was simple enough. A bench ran all around the inside of the wall, and on this the inhabitants both sat and slept. Poles swung horizontally from the roof supported strings of braided corn, baskets or bags of food, and other paraphernalia. A hole was left in the roof, directly over the hearth, for the smoke to escape.

Another kind of house, and one that was probably used most frequently in the summer, was a square lodge, made of poles and bark, with



A MOHAWK CHIEF FROM THE MOHAWK VALLEY

Note the wampum belt. His totem, the Wolf, is shown beside him.
From an engraving in the possession of the New York Historical Society.

a pointed or rounded roof in which a long slot was left at the ridge for the escape of smoke. Such a house was commonly occupied by a number of related families, and corresponded in many ways with the long tenements of the Iroquois. None of the houses and few of the villages of the local Indians were ever defended by palisades or trenches.

We are told by the old writers, and archaeological investigation confirms them, that the household utensils of the Indians were pottery vessels, nearly always, curiously enough, made with a pointed bottom, so that they had to be propped up with stones when in use, calabashes or gourds for water, spoons of shell and wood, wooden bowls laboriously made by burning and scraping knots or burls of trees, and bone awls and other tools.

The Indians derived their livelihood by farming a little, for they raised corn, beans, pumpkins, squashes, melons, and tobacco; but mostly by fishing, oystering, and clam gathering. They also were good hunters, as the bones of various animals, so common on their old kitchen refuse heaps, abundantly prove. However, from the vast heaps of oyster, clam, mussel, and other marine shells, that may be found scattered about the old Indian camping grounds, it is obvious that the sea furnished most of their food.

They caught fish in the seines and gill nets, by harpooning, and by shooting with the bow and arrow; they killed deer and other game with the bow and arrow, often hunting in large companies. This was, with the waging of war, the duty of the men; the women tended the fields and probably built and owned the lodges.

In their fishing, and for traveling by water, our Indians used canoes, sometimes made from heavy elm-bark but more often hollowed out of logs. Roger Williams says of the Narragansett and their neighbors:

Obs: Mishoôn, an Indian Boat, or Canow made of a Pine or Oake, or Chestnut-tree: I have seene a Native goe into the woods with his hatchet carrying onely a Basket of Corne with him, and stones to strike fire when he had felled his tree (being a Chestnut) he made him a little House or shed of the bark of it, he puts fire and followes the burning of it with fire, in the midst in many places: his corne he boyles and hath the Brook by him and sometimes angles for a little fish: but so hee continues burning and hewing untill he hath within ten or twelve dayes (lying there at his work alone) finished, and (getting hands), launched his boate with which afterward hee ventures out to fish in the Ocean.

* * * * *

Obs. Their owne reason hath taught them, to pull off a Coat or two and set it up on a small pole, with which they will saile before a wind ten, or twenty mile &c.

* * * * *

Obs: It is wonderfull to see how they will venture in those Canoes, and how (being oft overset as I have myselfe been with them) they will swim a mile, yea two or more safe to Land: I having been necessitated to passe Waters diverse times: with them, it hath pleased God to make them many times the instruments of my preservation, and when sometimes in great danger I have questioned safety, they have said to me: Feare not, if we be overset I will carry you safe to Land.¹

The NEW YORK TIMES for July 16, 1906, writes:

Cherry Hill was the centre of an excited crowd all day yesterday when the news got about that some workmen had dug up an old Indian canoe in an excavation at the corner of Cherry and Oliver Streets.

Men, women, and boys and girls flocked to the spot, and so blocked the streets that the police of the Oak Street Station had to be sent there to keep order.

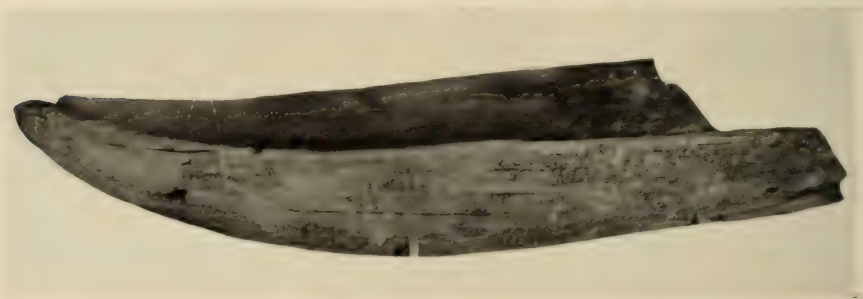
The lower part of Oliver Street is made ground, for in the old days the waters of the East River used to wash above the Cherry Street line.

Workmen from the New York Edison Compnay had made an excavation about eight feet deep when they came to what seemed to be a big log near the bottom. They dug around this and disclosed to view what the police and all others who viewed it said was half of an Indian canoe. Then the workmen, who don't take much interest in anything pertaining to the American Indian, promptly got an axe and chopped away until they got out the timber in sight, leaving the other half still buried in the mud.

In doing this they split the canoe into three pieces, and, followed by an admiring crowd, it was carried to the corner of Frankfort and Pearl Streets, and deposited on a pile of dirt under the Franklin Square elevated station, where the night watchman could keep his eye on it until to-day, when the workmen expect to get the other half and piece the canoe together.

It is supposed that the canoe was lying in the mud a hundred years ago or more, when the river front was filled in to make more land.

The part saved is about 7 feet long and 3 feet wide, and 14 inches deep, and tapers to an abrupt and rounded end, which is sharp, somewhat like the Indian canoes of the Western Indian. The whole was hewn from a solid log of white pine about fourteen feet long.



PART OF DUGOUT CANOE

Found at Cherry St., New York. The only known fragment of a canoe used by the Indians of Manhattan.

¹Collections of the Rhode Island Historical Society, vol. 1, pp. 98-99, Providence, 1827.

The Indian children, shortly after birth, were bound to a stiff board, which served as a cradle, and there they were kept until they were able to walk and run about. This served the double purpose of supporting their backs and also of keeping them out of mischief.

The religion of the Manhattan and their neighbors was a nature worship, pure and simple. They believed that there were deities who dwelt in the four quarters of the compass, that the sun and moon, the thunder and the winds were various supernatural beings. That these were all controlled by a supreme god whom they called "Kickeron," or "Kickerom," was their conviction. They thought that the earth was populated by the descendants of a woman who fell from the sky and who would have been lost in the sea, save that a gigantic tortoise which afterwards became the earth, caught her on his back. They were also in fear of a terrible evil power, a horned snake, to whom they made sacrifices by burying objects in the ground in its name.

The Manhattan and their neighbors also believed in a future existence, placing their Elysian fields in the southwestern skies, where they believed the souls of their dead journeyed. It was for this reason that they placed food and implements in their graves with the bodies, so that the wandering soul might lack nothing necessary to its comfort on the trip.

The religion of the Indians was marked by periodic ceremonies, one of which has come down to the present day among the modern remnants of the Shinnecock of Long Island and the Mohegan of Connecticut. This is the "June Meeting," which was formerly a ceremony held for the green corn. The Delaware in Oklahoma and Canada still perform a number of other annual ceremonies.

The old writers tell us that each Indian had some such name as "Buck's Horn," "Wildcat," or "Rattlesnake," and that when he died it was considered sacrilegious ever to mention his name again. It is also known that polygamy was practised by the local Indians.

THE ARCHAEOLOGICAL EXHIBITS.

So much for the ethnology of the Manhattan and their neighbors. Let us now turn to their archaeology as set forth by the specimens on view in the entrance of the Woodland Hall.

On entering the Eastern Woodland Indian Hall the visitor will find that the first table sections are devoted to an exhibition, as comprehensive as possible, showing the life of the natives in prehistoric times by



INWOOD ROCK-SHELTER, MANHATTAN



FINCH'S ROCK HOUSE

means of specimens obtained from the ancient village and camp sites. Here may be seen remains of the various animals, fish, and shell-fish upon which the Indians depended for subsistence; fragments of nuts, corn, roots, and other food products, preserved by charring, and obtained from ancient fireplaces; and such implements as arrow points of antler and stone, net-sinkers of stone, and stone hoes for tilling the field, all illustrative of primitive methods of hunting and agriculture. Implements exhibited in the same case show the preparation of animal and vegetable food with primitive utensils, while close by are tools used by the Indians in preparing skins. The manufactures of the Indians are illustrated in the immediately adjacent section.

A progressive series of implements shows the making of an arrow point from a simple quartz pebble such as might be picked up anywhere on the shore, with the various stages leading to the finished point; the tools employed are also exhibited. Implements of stone for pecking, grooving, and polishing; hatchets and axes; pottery fragments, and household utensils, such as hammers, axes, adzes, and gouges, will be found at hand.

In the upright cases there is an exhibit from Manhattan Island, made up of specimens principally collected by Messrs. Alexander C. Chenoweth, W. L. Calver, and R. P. Bolton, in the rock-shelters and village sites at Inwood, showing as fully as possible the life of the prehistoric Manhattan Indians.

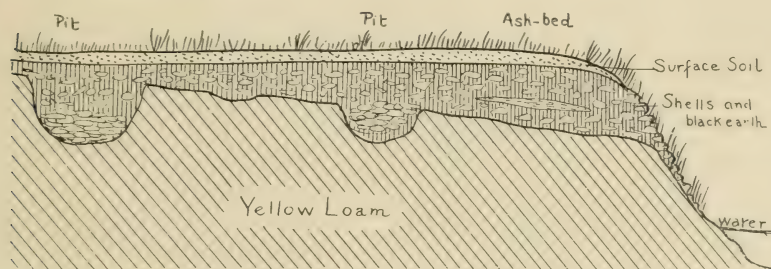
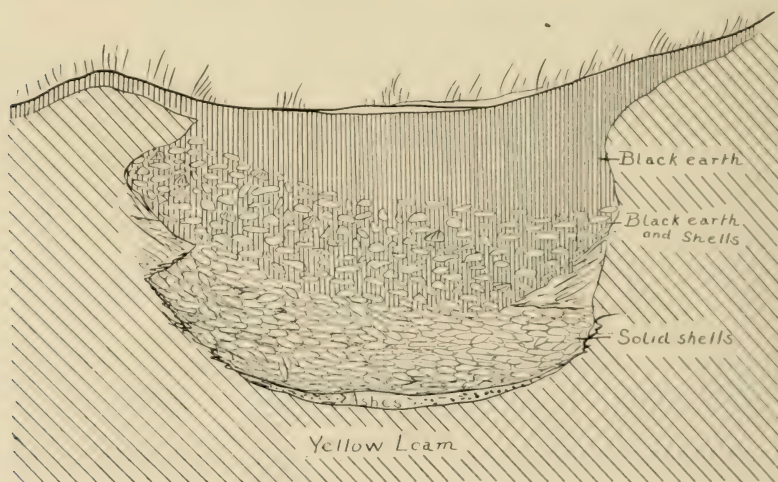


DIAGRAM OF A TYPICAL SHELL DEPOSIT

In another table case are to be seen implements and remains from the shell-heaps marking a long-forgotten Indian village at Shinnecock Hills, Long Island. This exhibit, which is one of the most complete of its kind, gives a rather adequate picture of the ancient life of these people and is especially valuable for the number and variety of primitive manufactures shown. One of the most interesting of the sections demon-

strates, by means of a series of specimens, the primitive methods of cutting bone and antler employed by these Indians. Bone was cut by notching or grooving it with a stone knife or flake, and then breaking it at the groove. Antler was worked in the same way, but it is very probable that the Indians boiled antler in order to make it more pliable and easily cut.

From the appearance of pottery fragments now to be found on the sites of the ancient Indian villages of this vicinity and the methods of modern Indian pottery makers, we may safely conclude that most, if not all, of the earthenware manufactured in this locality was made by the coil process, which consisted of the following steps: The Indians first secured clay of a suitable quality, which was mixed with pounded shell or stones to make it tougher and more durable. It was then worked into long rolls, and the Indians, beginning at the bottom, worked the pot up by adding coil after coil, blending or smoothing the coils with a smooth stone until they did not show from either the interior or exterior surface. When the pot was completed, it was decorated by stamping or incising designs about the exterior of the rim.



CROSS SECTION OF A SHELL PIT

The upright case at the end contains an exhibit from the remnants of the Algonkin and Iroquois Indians of New York State and New England, while a map showing the location of most of the Indian villages of Greater New York and vicinity and an actual section of a typical shell-heap, as well as photographs and labels describing the opening and exca-

vation of the sites, are near at hand. Specimens typical of those found in the shell-heap are also exhibited.

Of all the traces left by the aborigines along the New York seacoast, the most abundant and familiar are the shell-heaps. These are beds of refuse marking the sites of ancient villages, camps, and isolated wigwams. Wherever the fresh water joins the salt, especially where open water for fishing and a spring for drinking come together in happy combination, there is generally to be found some such evidence of Indian occupation.

The typical "shell-heap" is not a heap at all, for leaf mold, the wash from neighboring high ground, and often cultivation have generally made it level with its surroundings (page 14). Very often, unless the land be plowed, no shells whatever show on the surface, and the only way of finding out the condition of things below the sod is to test with a spade or a crowbar. If shells are present, their crunching soon gives notice of the fact. Sometimes shell-heaps have been located by shells thrown from animal burrows, or washed out by the rain, or in banks broken down by the surf. Some have been found fronting on the open Sound, but such cases are rare. These deposits consist of large quantities of decayed oyster, clam, and other marine shells mixed with stained earth, with ashes, charcoal, and fire-cracked stones to mark the spots where ancient camp fires blazed. Among the shells are usually scattered antlers of deer, bones of animals, fishes, and birds, quantities of pottery fragments, and broken implements; in short, the imperishable part of the camp refuse left by the Indians. Now and then, perfect implements and ornaments that had been carelessly lost in the rubbish or hidden for safe-keeping are discovered.

Shell-heaps vary from a few inches to four feet in depth, and in area from a few square yards to several acres—all depending on the length of time the settlement was occupied and the number of dwellings comprising it. Deep shell-heaps are often divided into layers, the lowest of which are, of course, the oldest. Under and near most of these deposits may be found scattered "pits" or fire holes, which are bowl-shaped depressions in the ground filled with layers of stained earth, shells, and other refuse, with an occasional layer of ashes. Some pits are as large as ten feet wide by six feet deep, but the average is four feet deep by three feet wide. It is supposed that they were used as ovens or steaming holes and afterwards filled up with refuse. Some contain human skeletons, which may have been interred in them during the winter season when grave digging was impossible. These pits generally contain more of interest than the ordinary shell-heap. The closely packed regular masses

of shells form a covering which tends to preserve bone implements, charred corn, and such perishable articles from decay in a way that the looser shells of the general layers fail to do.

Shell-heaps, while abundant along the seacoast, are seldom found inland, except on salt creeks or other streams having access to salt water. They may be seen all along the east shore of the Hudson River at more or less frequent intervals as far up as Peekskill; on Croton Point and between Nyack and Hook Mountain on the west shore they attain considerable size. There are a few small deposits, however, composed



MAP GIVING THE LOCATIONS OF SHELL DEPOSITS

Those marked + have been explored by the Museum

mainly of fresh water clams (*Unio*) situated on fresh water lakes in the interior of Westchester County. There are many shell-heaps on Staten Island. Shell-heaps occur or did occur on Constable Hook, New Jersey, and at intervals between there and Jersey City along the western shore of New York Bay. The accompanying map gives the location of the important known shell deposits in the vicinity of New York City.

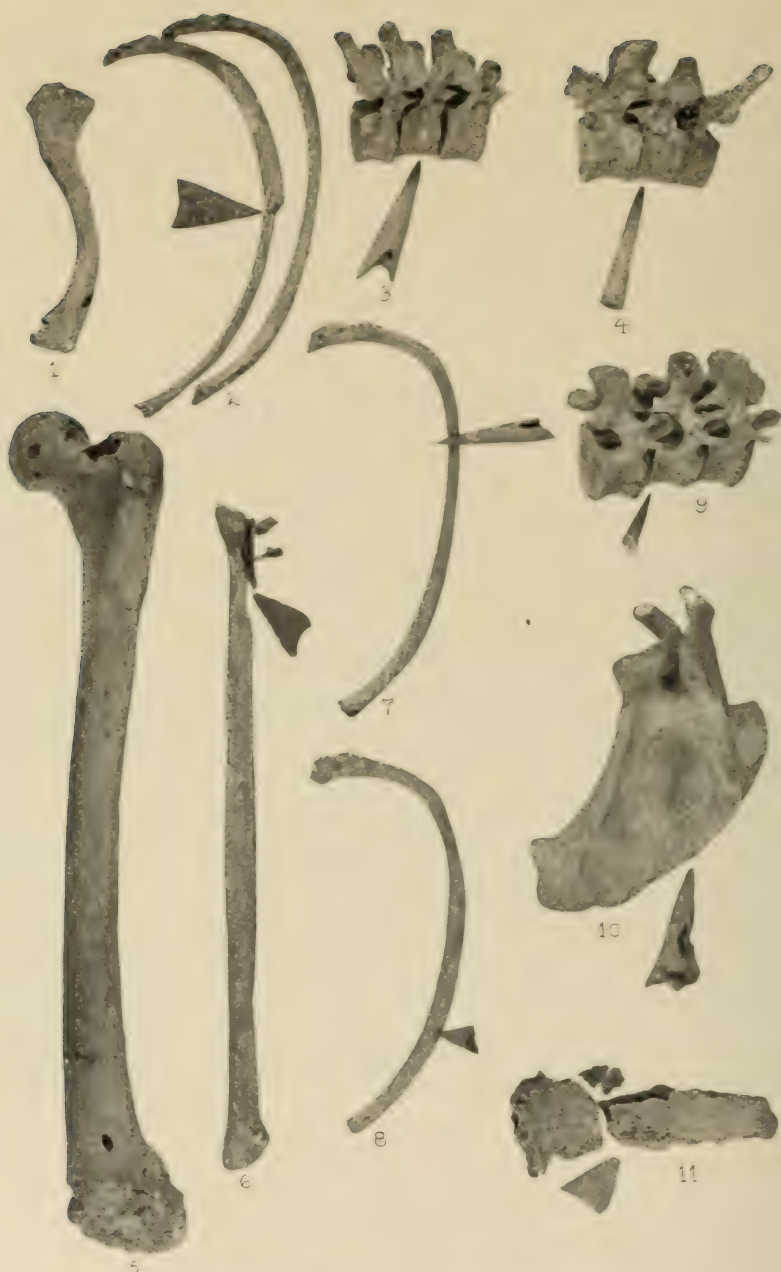
Besides the shell-heaps, the ancient cemeteries of the Indians hold much of interest to the archaeologist.

Although most of the natives in the vicinity of Greater New York did not place objects in the graves with their dead, some graves at Burial Ridge, Tottenville, Staten Island, when opened for the Museum in 1895, were found to contain a great many interesting and valuable remains. With the skeleton of a child there was a great deposit of utensils, both finished and unfinished ornaments, such as beads, pendants, and



INDIAN SKELETONS PIERCED BY ARROW POINTS, TOTTEVILLE, STATEN ISLAND

the like, a stone pipe, and a number of other objects, while not far away the skeletons of three Indian warriors were exhumed, in and among whose bones there were found, as shown in the cases devoted to the archaeology of Staten Island, twenty-three arrow points of stone, antler, and bone.



BONES PUNCTURED BY ARROW POINTS, FROM SKELETONS
FOUND ON STATEN ISLAND

This is an exhibit which excellently indicates the use of the bow in Indian warfare. In the first skeleton, it was found that two arrow points of antler and one of bone had pierced the body and lodged near the spinal column. Another point of argillite had been driven between two ribs, cutting a notch in each. A bone arrow point had struck the shoulder and was resting against the scapula. Among the bones of the right hand, an arrow point of antler was discovered, and there was a similar one near the left hand. Another antler point was lying in the sand just beneath the body and had, no doubt, dropped from it when the flesh wasted away. The most interesting wound of all was one where an antler-tipped arrow had plowed through one side of the body and fully one-third of the point had passed through one of the ribs, making a hole, in which it remained. The second warrior was also terribly injured. The left femur showed an elongated puncture near the lower end, probably made by an arrow point. Among the ribs was the tip of an antler point, and another of yellow jasper was among the ribs on the left side of the body. Three other points were among the bones. The third skeleton was likewise an example of old-time bow play. There was an antler point among the ribs on the left side. The end of one of the fibulæ was shattered by a stone arrow-head, and a second point had lodged between two ribs. Beneath the sternum was a flint point, and the right shoulder blade showed a fracture near the end, caused by a blow of some hand implement or an arrow. Near the base of the skull, the end of an antler arrow-head was discovered, broken perhaps by its impact with the occiput. Two bone points were near the lower bones of the left leg. A second point was found upon search among the left ribs; under the vertebræ was the base of another antler point, and two broken points were found beneath the body.

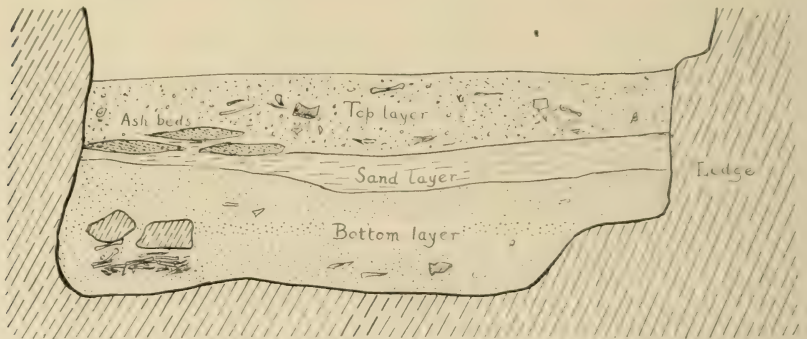
The positions in which several of the points were found certainly speak well for the great force which propelled them. The long bows of the local Indians must indeed have been formidable weapons. Taking into consideration the number of arrows which must have been imbedded in the bodies of the warriors, it is perhaps probable that the majority of the projectiles were driven into the victims at close range after death.

In a small square case will be found the model of a rock-shelter and typical objects found in such places. These rock-shelters, as the name implies, are protected spots in rocky ledges, which Indians once made more or less permanent places of abode. Many such shelters exist in the vicinity of New York, two or more having been discovered at Inwood, Manhattan. The most important rock-shelter so far discovered is the

so-called Finch Rock House reproduced in a model. The original is near Armonk, Westchester County, New York. One point of special interest is the fact that the Finch shelter contained two layers bearing relics separated by sand as shown in the drawing. As no pottery was found in the bottom layer, it has been inferred that we have here the remains of two different races of Indians, the older not yet advanced to the pottery-making stage. This conclusion, is, however, far from final, for the whole arrangement may be due to accident.

In the table cases opposite those devoted to the Algonkin some sections are used to show the life history of the Iroquois tribes of western New York, and the following section shows, as well as possible, the culture of the Five Nations and objects used by the Indians of New York State obtained from European traders after the advent of the settlers.

With the Iroquois exhibit is a special exhibit showing typical wampum beads, belts, and implements illustrating the prehistoric manufacture of wampum on Long Island.



VERTICAL SECTION OF REFUSE IN FINCH'S ROCK HOUSE,
ABOUT MIDWAY OF THE CAVE

TYPES OF INDIAN RELICS FOUND IN AND ABOUT NEW YORK CITY

HAVING now taken a general view of the exhibit, the visitor may be interested in a study of the several kinds of relics found in this locality. As these types are somewhat unlike those found in near-by regions, we conclude that the Indians formerly living here had habits and customs different from those of their neighbors. For want of a better name, these long-extinct tribes have been called collectively the New York Coastal Algonkin. The term Algonkin designates the



TYPES OF ARROW POINTS

language they spoke, while the adjectives define their habitat. Under the designation New York Coastal Algonkin, the writer includes the tribes along the coast from Tottenville, Staten Island, the extreme southern point of the state, to the Connecticut boundary on Long Island Sound, including to a certain extent the shores of New Jersey immediately adjacent to Staten and Manhattan Islands, the east bank of the Hudson River as far north as Yonkers, and the western end of Long Island.

From the examination of the remains of the New York Coastal Algonkin area preserved in many collections, both public and private, it becomes obvious that the objects found may be roughly divided into three groups: articles of stone, articles of bone and antler, and articles of clay, shell, and metal. The first group is, from the imperishable nature of its representatives, naturally the largest and comprises a number of sub-groups to be briefly described and commented upon in this paper. Examples of this type will be found in the table cases previously mentioned. For the following descriptions and historical notes the author has largely drawn on Mr. James K. Finch's and his own contributions to Volume III of the "Anthropological Papers of the American Museum of Natural History" (New York, 1909).

CHIPPED ARTICLES.

Arrow Points. Two general types of arrow points may be recognized: these are the stemmed, or notched, and the triangular forms. The former are by far the most abundant, and while these are usually made of the nearest local rock possessing the necessary conchoidal fracture, in some cases they are of material brought from a long distance. Specimens made of pink flint resembling stone from the Flint Ridge of Ohio, and of jasper found to the south of this region, have been recorded. Blunt arrow points are rare, the Indians probably preferring wooden arrows for this type. Many of the so-called "blunt points" found in collections appear to be scrapers made over from broken arrow points of a large size.

The triangular type has long been regarded by the local collectors of this vicinity as being the type used in war, the argument being that as it has no stem, it was necessarily but loosely fastened in its shaft and, if shot into the body, would be very liable to become detached and remain in the flesh if any attempt were made to withdraw it by tugging at the shaft. While it was no doubt perfectly possible to fasten a point of triangular shape to the shaft as firmly as a notched point, the discoveries of Mr. George H. Pepper at Tottenville, Staten Island, where twenty-three arrow points were found in and among the bones of three Indian



KNIVES AND SCRAPERS

skeletons, tend to strengthen this theory. While the majority of points found there were of bone or antler, all those made of stone were of this type; indeed, most of the bone points were also triangular in shape. However, it is well to bear in mind that arrow points of triangular type were used for every purpose by all the early Iroquois tribes of New York.

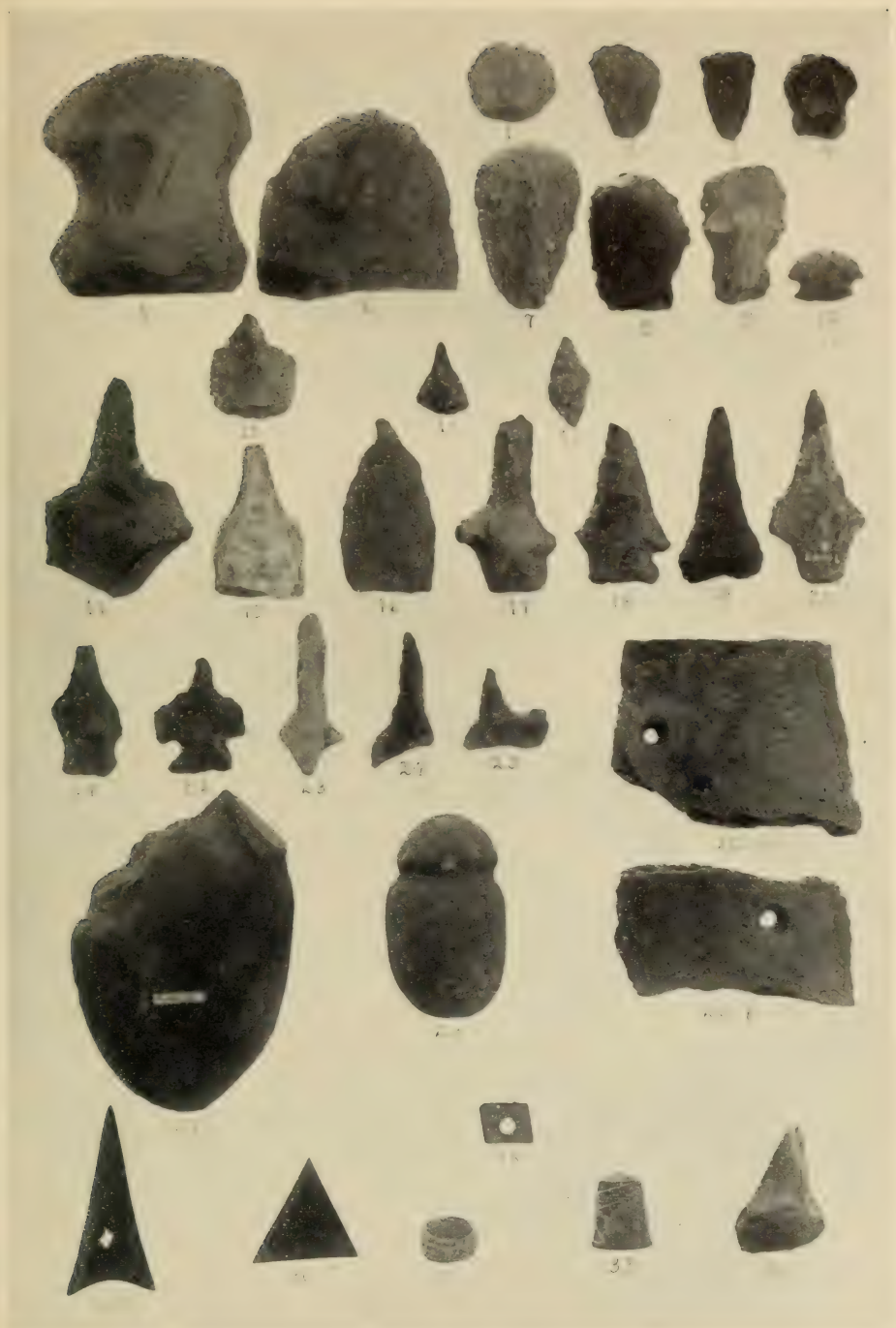
Spear Points and Knives. None of the early accounts of contemporary European writers seem to mention the use of spears (other than bone or antler-headed harpoons) by the Indians hereabouts, and it is probable that the larger arrow-point-like forms found were used as knives or cutting tools. They are usually notched or stemmed, rarely triangular, and occasionally round or oval. They vary in size, but it must be remembered that one tool may have had various uses, and that drills, knives, and scrapers may often have been combined in one implement.

Scrapers. Scrapers were probably used in dressing skins, in sharpening bone implements, wood-working, and for various other purposes. These are usually mere flint flakes chipped to an edge on one side. Nevertheless, notched and stemmed forms requiring some care in their making do occur. Broken arrow points were occasionally chipped down to serve this purpose. A single serrated scraper has been found. These are very rare in both the Algonkian and Iroquoian areas of New England and the Middle Atlantic States. One very large stemmed scraper, of a type more common in the far west, also comes from this locality.

Drills. These are usually chipped tools presenting an elongated narrow blade and a considerably swollen or expanded base, suitable for grasping in the hand. In some cases the base was absent and those were probably hafted in wood. Specimens whose blades have a square or rectangular cross-section are very rare. The finding of cores left in half-drilled objects shows the use of a hollow drill, and it has been suggested that a hard hollow reed used with sand and water on a soft stone would produce this effect. To bear out this assertion, it has been reported that a half-drilled implement has been found outside this area on the upper Hudson in which the remains of the reed drill were found in the cavity left by its action.

ROUGH STONE ARTICLES.

Hammerstones. These vary from simple pebbles picked up and used in the rough, showing merely a battered edge or edges acquired by use, to the pitted forms. They are generally mere pebbles with a pit pecked on two opposite sides, perhaps to aid in grasping with the thumb



DRILLS, SCRAPERS AND OTHER OBJECTS

and forefinger. Some have battered edges, but many have not, suggesting, when round and regular, a use as gaming or "Chunké" stones, or as implements used only in pounding some rather soft substance. Hammer-stones, pitted on one side only, and others with many pits on all sides, occur. These latter may have had some special use, and are not to be confounded with the large, flat, slab-like stones having pits only on one side, found in other regions, and perhaps used as receptacles for holding nuts while cracking them. While these are common in the Iroquoian area, they are unknown here.

Large stones, single or double-pitted, resembling over-sized hammer-stones, occur. These may have been used as anvils in chipping flint or for like purposes.

Grooved clubs or mauls, also showing use as hammers, are found. These are rare and are usually either rough pebbles, grooved for hafting, as in the case of the grooved axe, or grooved axes, the blades of which have become so battered, broken, and rounded by wear as to preclude their further use for chopping.

Net-Sinkers. On all sites near the water, either salt or fresh, net-sinkers show the prevalence of fishing. These are of two types. In one case a pebble is notched on opposite sides of either the long or broad axis; in the other, a groove is pecked around the entire pebble in the same manner. The latter type is comparatively scarce, as the former, being more easily and quickly made, was just as useful to the savage. The modern Cree and Ojibway, residing in the forests north of the Great Lakes, still use pebbles for this purpose, but those observed by the writer were not notched or worked in any way. Occasionally, sinkers notched on both axes are found in this region.

Hoes. These are usually ovoid implements, chipped from trap rock, sometimes notched to facilitate hafting, and sometimes not. They usually show a slight polish on the blade, caused by friction with the ground. This type of stone hoe is the form mentioned by early writers; but perhaps hoes of shell, bone, or tortoise shell, and wood were used also. None of these, however, are still in existence.

Hand Choppers. Pebbles chipped to an edge on one side, for use as hand choppers, occur. These are occasionally pitted on both sides.

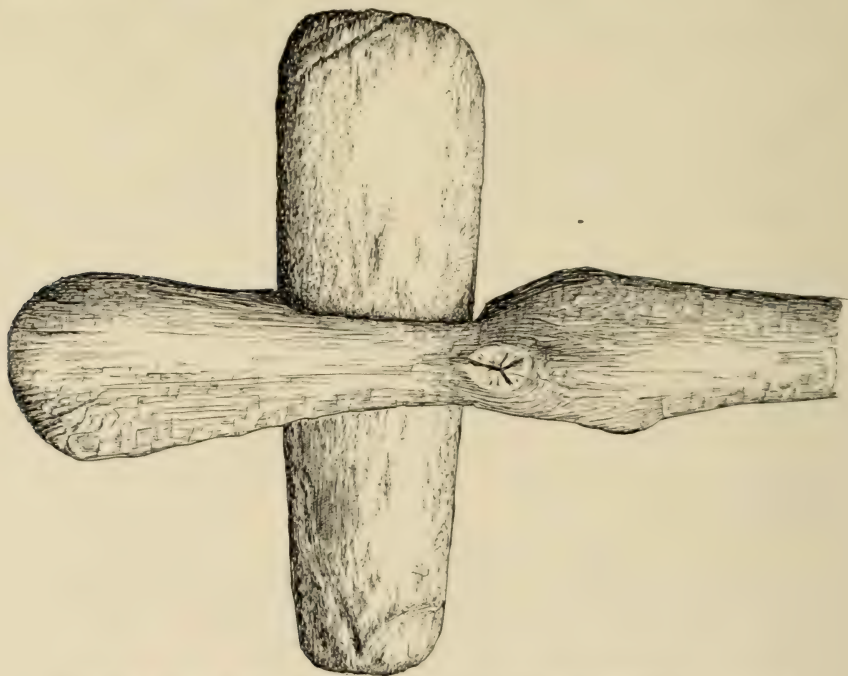
Grooved Axes. For the purposes of this paper, the writer, while aware that many grooved axes are well made and polished, has decided to include them under the head of "Rough Stone Articles," as by far the greater majority of the grooved axes and celts from this region lack the polish and finish belonging to other articles later to be described.



TYPES OF STONE AXES AND CELTS

Grooved axes are of two sorts: *a*, those made of simple pebbles, merely modified by grooving and chipping or pecking an edge; and *b*, axes which have been pecked and worked all over and sometimes polished. The latter (*b*) may be said to include:

1. Groove encircling three sides of blade, one side flat.
2. Ridged groove encircling three sides of blade, one side flat.
3. Groove encircling three sides of blade, longitudinal groove on flat side.
4. Groove encircling three sides of blade, longitudinal groove on flat side and opposite.



HAFTED CELT FROM A POND AT THORNDALE, DUTCHESS, CO., N. Y.

Length of celt 16.6 cm.

5. Groove encircling blade.
6. Ridged groove encircling blade.

A seventh type, having a double groove encircling the blade, may occur in this territory, but has never been reported. A specimen from the Hudson River region, just north of the area here dwelt upon, is in the Henry Booth Collection in this Museum. While most worked stone

axes have been pecked into shape, a few have been fashioned by chipping, but these seem to be rare.

Grooved axes were hafted in various ways. During the summer of 1908, the Eastern Cree living in the vicinity of the southern end of Hudson Bay told the writer that their ancestors, who made and used such axes, hafted them by splitting a stick and setting the blade in it, then binding the handle together with deerskin (probably rawhide) above and below the split. No specimens of the grooved axe in the original haft seem now to be extant from any locality in the East. From the battered appearance of the butts of these axes, it may have been that they were sometimes used in lieu of mauls or hammers. It is possible that they may have been used in war. It is generally supposed that in cutting down trees, making dug-out canoes, and other kinds of wood-working, fire was used as an adjunct to the stone axe, the former being the active agent. The process of burning and charring having gone on sufficiently, the stone axe was used to remove the burned portion. However, some stone axes seem sharp enough to cut quite well without the aid of fire.

Celts. Ungrooved axes or hatchets, usually called celts, are frequent throughout this area; but are nowhere as abundant as the grooved axe, especially near the southern border of the region. The grooved axe seems to have been the typical cutting and chopping tool of the local Algonkin. The widespread idea that the celt was sometimes used unhafted as a skinning tool, has no historic proof, but may possibly have some foundation. The Cree of the southern Hudson Bay region use an edged tool of bone for this purpose, a fact which is somewhat suggestive, although the implement differs in shape from the celt. Celts with one side flat and the other beveled to an edge may have been used as adzes. From the worn and hammered appearance of the polls of some celts, it is possible that many of these implements were used as wedges in splitting wood, after constant manipulation in their chopping capacity had permanently dulled their edges.

The celts of this region are, as a general thing, poorly made, a pebble of suitable shape having an edge ground on it with little or no preliminary shaping. More rarely, however, they were carefully worked all over by pecking and polishing, as in the case of the grooved axe.

In type, aside from the general division of rough and worked celts, we may add that most celts in this region have slightly rounded polls, the bit broader than the butt, although some exceptions have been found. The forms are as follows: *a*, rough stone celts, pebbles with one end

ground to an edge, but otherwise scarcely worked; and, *b*, worked stone celts, which include the following:

1. Wedge-shaped, poll narrower than bit, and angles rounded. Common.

2. Like number one, but with bit much broader than poll. Cross-section oval. Very rare.

3. Like number one, but one side flat, other beveled at one end to make a cutting edge.

4. Like number two, but with cutting edge flaring, broader than body. "Bell-mouthed type." Very rare.

North and west of this region we find the Iroquois territory, where most worked celts are angular, having almost invariably a rectangular cross-section and squared butt. Types 1 and 3 also occur, but the celt with the rectangular cross-section seems most typical of the Iroquoian region. Many small celts, made of flat fragments or chips of stone, are also found in this area, and these could scarcely have had a use as chopping tools.

In the Niagara watershed and extending eastward as far as the Genesee Valley, an angular adze-like form having a trapezoidal cross-section occurs. It is found principally in what was the territory of the Attiwandaronk, Kah-Kwah, or Neutral Nation (an Iroquoian tribe, early annihilated by the Five Nations). It also occurs, as has been stated, on the sites of villages of the Iroquois proper, but is not abundant. South of the Iroquois in Central Pennsylvania, another form which does not occur in this region is the chipped celt, usually of flint or other hard stone. This form is, however, frequent in the country about the headwaters of the Delaware.

In the "American Anthropologist," Vol. 9, No. 2, p. 296 *et seq.*, Mr. C. C. Willoughby has figured and described the celts of the New England region with remarks on the methods of hafting employed. These seem to be two in number, and consist, in the case of the larger forms, of setting the blade through a hole in the end of a club-like handle, the butt or poll projecting on one side and the blade on the other as in one which was found in the muck of a pond bottom at Thorndale, Dutchess County, New York, a region once in the Mahikan territory. Smaller celts were set into a club-like handle, the butt resting in a hole or socket.

Adzes. These seem to be of two kinds, the first and most simple being celt-like, but flat on one side, the other side being beveled to an edge on one side. The second form differs in having a groove, which is not infrequently ridged. Occasionally, adzes with two parallel grooves



BANNER STONES, GORGETS, AND AMULETS

occur. They were probably hafted by taking a stick at one end of which projected a short arm at right angles with the shaft, laying the flat side of the blade against this arm and binding it on with sinew, thongs, or withes. The groove, of course, was of aid in securing the blade to the handle. Adzes of stone, hafted in this manner, have been obtained on the North Pacific Coast. The celt adze seems not uncommon, but the grooved adze is rare, neither form being nearly so abundant as in the New England region.

Gouges. The stone gouge is rare, and seems always to be a plain, single-bladed affair without the transverse grooves so frequently seen in New England specimens, and hereabouts is always easily distinguished from the adze. Less than half a dozen specimens have been seen by the writer from this entire area, although probably quite as much work in wood was done by the New York Coastal Algonkin as by the New England Indians.

Pestles. The long pestle occurs throughout the region of the Coastal Algonkin of New York, but is nowhere as abundant as in New England. They seem always to have been used with the wooden block mortar hereabouts, and are mentioned by the early writers as part of the household equipment of the natives. They do not seem to have been used by the Iroquois to the north and west of this area either in early or later times. The wooden pestle of dumb-bell shape seems to have been preferred by them. The latter is used by the Canadian Delaware and may have taken the place of the long stone pestle to a great extent in this region.

Mullers, Grinders, and Polishing Stones. These are frequent, and consist merely of rounded pebbles, shaped and worn by use, probably most often in crushing corn. They are mentioned by De Vries as being used by the Indians with a flat stone slab for grinding corn when traveling. Some seem to have been used for polishing stone implements, but it seems hard to draw the line, as the appearance gained from friction would be quite similar. Such mullers and their attendant slabs, used for preparing corn meal have within a few years been collected in use among the Oneida Iroquois of New York, one specimen being in the American Museum collection.

Sinew Stones. These are pebbles showing grooves along the edges, popularly supposed to have been worn there by rubbing thongs and sinews across the edges to shape them. They occur generally, but are not common.

Stone Mortars. These are common, but rather local, some sites having none at all, and others a good many. One locality on Staten Island is notable for the numbers found there, whereas they are rare elsewhere in that vicinity. They may be divided into the following types:

1. Portable mortar, hole on one side.
2. Portable mortar, hole on both sides (New Jersey type).
3. Portable slab mortar or metate, used on one or both sides.
4. Boulder mortar, one or more holes, immovable.

The first two types are the most abundant, the third is not uncommon, but the fourth is very rare, only one or two being reported. As above stated, De Vries claims that the portable mortars were used in bread-making while the Indians were traveling, but certainly the majority of those found are far too heavy for this purpose.

Pigments and Paint Cups. Fragments of pigments such as graphite and limonite, showing the marks of scratching with scrapers, are found, which have apparently supplied the material for painting. Worked geodes are common on many sites. These show traces of chipping in some instances and may have been paint cups. There is a tiny pestle-shaped pebble in the Museum collection from Westchester County, which is said to have been found with a geode of this type. The popular theory is that such geodes were used as "paint cups" and this seems probable.

Stone Plummets. These are very rare, in contrast to their abundance in the New England region. They consist usually of small worked egg-shaped stones, grooved at one end, probably for suspension. The writer has seen but one from this area. Their use is problematic.

Semilunar Knives. Knives of rubbed slate, similar in appearance to the ulu, or woman's knife of the Eskimo, are found, though rarely, in this region. While sometimes ascribed to Eskimo influence or contact, it is possible that this form (which occurs throughout New England), judging by its distribution, may have been native to the Eastern Algonkin also. The Eastern Cree still use knives of this type as scrapers. Like most other forms common in New England, it is less abundant in the southern part of this area.

Stone Beads. Various pebbles generally perforated naturally are to be found on some sites, and may or may not have been used as beads or pendants. On Staten Island, at Watchogue, Mr. Isaiah Merrill once owned a number of square beads of pinkish steatite (?), all but one of which have been lost, and which he claims were found on his farm.

Gorget. Two types of the gorget occur. These are the single-holed pendant form, which is the less abundant of the two, and the double-holed type. The latter is flat, rectangular in shape, and generally well polished. It usually has two perforations a short distance from the middle. The modern Lenapé of Canada claim to have used these as hair ornaments. Probably the two-holed variety is typical of the Algonkian peoples of this region; the single-holed form, on the other hand, is the most abundant on old Iroquoian sites. Specimens of the latter have been obtained in use among the Canadian Iroquois, and some of them are in the Museum collections.

Amulets. Certain problematic articles of the "bar" and even "bird amulet" type have been found, but these are probably exotic in origin and are not characteristic of the archaeology of the region in question.

Banner Stones. These beautiful polished stone implements of unknown use may be divided into three great classes, with several subtypes as follows:

1. Notched banner stones.
2. Grooved banner stones.
 - a. Groove on both sides.
 - b. Groove on one side.
3. Perforated banner stones.
 - a. Plain.
 - b. Butterfly.

All three types seem equally abundant, but the notched banner stones appear to be the oldest form and occur under circumstances pointing to great relative antiquity. They are found, however, on the more recent sites as well. Both the notched and the grooved banner stones are usually more rough in appearance than the perforated type, and the writer has never seen a polished specimen of the first class. On the other hand, the grooved variety frequently exhibits the high degree of finish characteristic of the perforated forms. Banner stones grooved only on one side are less common than the other forms. While the latter class is generally made of slate, steatite, or some similar soft and easily worked material, the notched and grooved forms, especially the former, are often formed either from naturally-shaped pebbles or chipped roughly into shape. Implements, usually naturally-shaped stones with little working, without notches, grooves, or perforations but greatly resembling the notched and grooved banner stones in shape, are not infrequently found on aboriginal sites hereabouts and may have served as banner

stones. There seem to be neither records nor plausible theories as to their use.

Pipes. Stone pipes, invariably made of steatite, are very rare. Four types have been noted as follows:

1. Monitor or platform pipe, platform not projecting before the bowl.
2. Monitor or platform pipe, platform projecting before bowl, with or without tiny carved stem or mouthpiece. Of the latter, one specimen is known.
3. Trumpet-shaped stone pipe.
4. Rectangular stone pipe, human face carved on front of bowl.

It may be remarked that more stone pipes have been reported from the Indian cemetery at Burial Ridge, Tottenville, Staten Island, than from all the rest of the area put together. The second and third types are represented by one specimen each from Burial Ridge and from nowhere else in this region. Four or five pipes of the first class have been found there as well. The last class is represented by a single specimen obtained by Mr. W. L. Calver at Inwood, Manhattan Island. Undoubtedly the clay pipe was the most common form used in this locality.

Steatite Vessels. These are not at all abundant, though occurring almost everywhere. They were doubtless all imported from New England, as there are no steatite quarries within the range of the New York Coastal Algonkin. The single form found is that common in the East, an oblong, fairly deep vessel with a lug, ear, or handle at each end. Occasionally, such vessels are ornamented by rude incisions along the rim.

ARTICLES OF CLAY.

Pottery Pipes are common everywhere. They are usually manufactured of a better quality of clay than that used for vessels, and bear fairly similar designs. They are susceptible of division into the following classes:

1. Straight tubular form, bowl expanding slightly.
2. Bowl much larger than stem, leaving it at an angle of forty-five degrees. Stem round.
3. Same as number 2, but stem angular and much flattened.
4. Effigy pipes (represented by a human head apparently broken from a pipe bowl, obtained by Mr. M. R. Harrington at Port Washington, Long Island).

The straight pipe seems to have been obtained only on Staten Island, on the north shore, in the region occupied by the Hackensack. While nowhere as abundant as upon the Iroquoian sites of central and western New York, the clay pipe is rather common and is a prominent feature in the coast culture of New York. It is more abundant perhaps in the southern part of the area, but this may well be due to the fact that data from this region are more easily accessible. The triangular-stemmed "trumpet" pipe so common on the Iroquoian sites is unknown in this region.

POTTERY VESSELS.

The pottery of this region may all be considered as being either the native Algonkian in type or showing Iroquoian influence with a third and intermediate variety. Algonkian vessels may be divided into the following groups according to shape:

1. Conical, pointed bottom, slightly swollen sides, circumference largest at the mouth,—the typical Algonkian pot of this area, Fig. a.
2. Like number 1, but much rounder and broader, Fig. b.
3. Bottom pointed, sides slightly swollen, neck slightly constricted, Fig. c.
4. Identical with number 2, except that just below the beginning of the neck, occur small raised lugs, ears, or handles. This is rare from this area, Fig. d.
5. Rounded bottom, somewhat constricted neck, lip sometimes flaring, or even turning down and back, Fig. e.

The intermediate types are as follows:

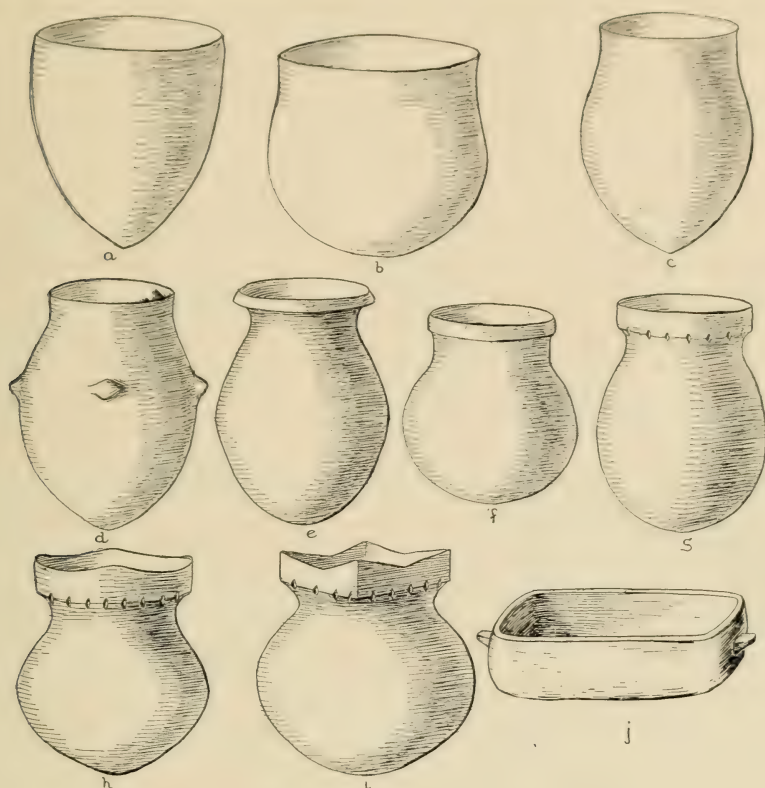
6. Rounded bottom, constricted neck, narrow raised rim or collar, Fig. f.
7. Like number 6, but with sides more elongated and bottom more oval than round, heavier collar, generally notched angle, with or without a series of small humps or projections at intervals, Fig. g.

The Iroquoian types are as follows:

8. Mouth rounded, collar or rim heavy, with humps or peaks at intervals, angle notched, neck constricted and bottom rounded; can stand by itself, an unknown feature in local Algonkian vessels, Fig. h.
9. Same as number 7, but with mouth square, and humps at every angle. Much less common than in the preceding, Fig. i.

In size, the vessels range from small toy-like pots to jars of very large capacity. In general they appear to have been made by the coil process, and are tempered with pounded stone or fine gravel, mica or burned or

pounded shell. Sherds showing tempering by fiber or some other substance that disappeared in firing are found rarely. When vessels were cracked or broken, a series of holes was bored opposite each other on either side of the break and the parts laced together, rendering the vessel capable of storing dry objects, at least.



POTTERY FORMS OF THE COASTAL ALGONKIN

Life forms are exceedingly rare in local ceramic art. From Manhattan Island and Van Cortlandt Park, there come a number of specimens showing incised human (?) faces. This is not an uncommon form on Iroquoian sites in Central and Western New York. On the Bowman's Brook site at Mariner's Harbor, Staten Island, fragments of a typically Algonkian pot were obtained which bore at intervals rude raised faces. With the sole exception of a rather well-modeled clay face, apparently broken from the bowl of a pipe found at Port Washington, Long Island,

by Mr. M. R. Harrington, this brief statement concludes the list of pottery life forms reported from this area, although others may yet be found here, since some interesting objects have been collected in immediately adjacent territory.

The forms of decoration consist of stamping with a stamp, roulette, or paddle, and incising. Occasionally, but very rarely, stucco work occurs. Under stamping we can enumerate the following processes:

1. Impression with the rounded end of a stick (rare).
2. Impression with the end of a quill, or hollow reed, leaving a circular depression with a tiny lump or nipple (rare) in the center.
3. Impression with a section of a hollow reed, making a stamped circle (rare).
4. Impression with finger nail (doubtful, but perhaps used on some sherds from Manhattan Island).
5. Impression of the edge of a scallop shell.
6. Impression with a carved bone, antler, or wooden stamp.
7. Impression of a cord-wrapped stick.
8. Impression with roulette.

Under the head of decoration by incision we can enumerate the following:

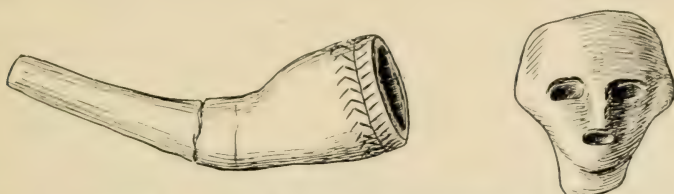
9. Incised decoration, probably made with a stick.
10. Incised decoration, possibly made with a flint object (only one specimen at hand).

The paddle was frequently used to finish the sides and bottom of the pot by imparting an appearance of pressure with fabric when the clay was wet.


11. Stucco. Occasionally, ridges of clay placed on the rim for ornament appear to have been added after the shaping of the vessel.

Ornamentation is usually external, and vessels, either Algonkian or Iroquoian, are rarely ornamented below the rim, although occasionally the designs run part way down the side in the case of the Algonkian forms. Where decoration has been applied by one of the stamping processes, and more rarely by incision, it is sometimes continued over the lip or rim for an inch or less on the inside. This only occurs in the typical Algonkian forms, and is never seen when incised ornamentation is used. The rims of Iroquoian vessels are never ornamented on the interior, nor is stamping so frequently practised on vessels of this class. The intermediate forms, at least the first of the two mentioned, are frequently ornamented on the interior of the lip. This internal decoration is much more common in the southern portion of this area than elsewhere in the vicinity.

In design, we must of course give up all thought of trying to obtain symbolism, if such there were, for there are no sources now left upon which to base our assumptions. Certain conventional types of decoration seem to have been in vogue, usually consisting in rows of stamped or incised parallel lines and much more rarely of dots regularly arranged in the same manner. Zigzag, chevron, and "herring bone" patterns are the most common, but other angular forms occur, and rows of parallel lines encircling the vessel are sometimes to be found. Stamping and incising as decorative processes never seem to occur on the same vessel.



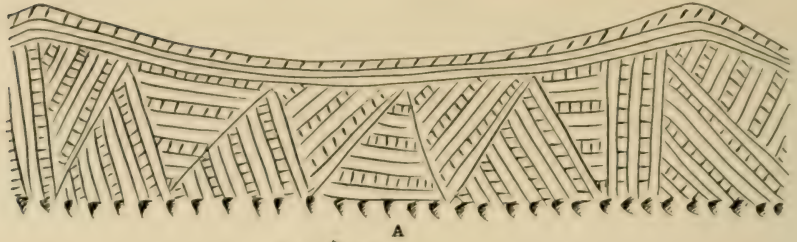
**TYPICAL ALGONKIAN POTTERY PIPE AND FRAGMENT OF AN EFFIGY PIPE
FROM PORT WASHINGTON, L. I.**

Curvilinear decoration is exceedingly rare, and not enough material is at hand to show that patterns were used; possibly these were scrolls of some form. On account of the lack of material, it cannot be determined, except in a very general and unsatisfactory way, whether the designs on the Algonkian vessels differ from those on the Iroquoian. 

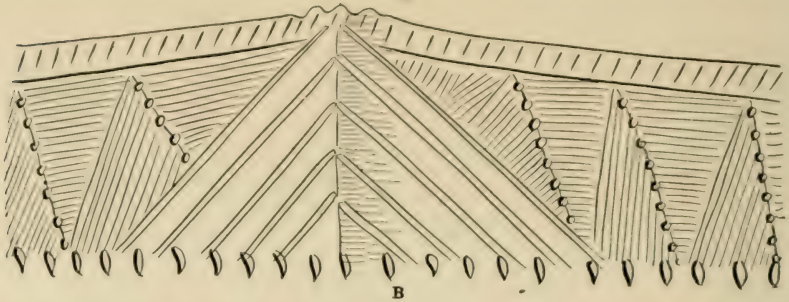
The angle formed where the heavy rim or collar leaves the constricted neck of the Iroquoian vessel is almost invariably notched, and as such collars and angles do not occur on vessels of the true Algonkian type, this feature is necessarily absent from them. It is noticeable that Iroquoian vessels are usually decorated with incised designs, rather than stamped patterns.



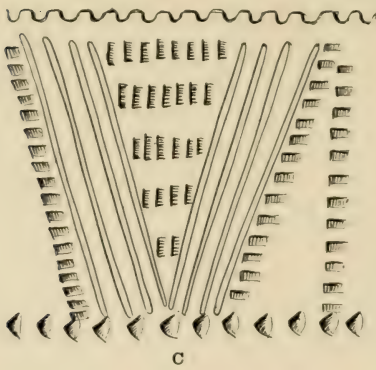
INCISED DESIGNS FROM ALGONKIAN VESSELS



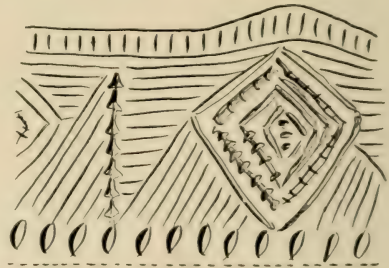
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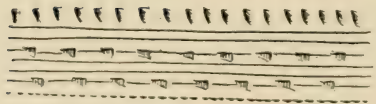
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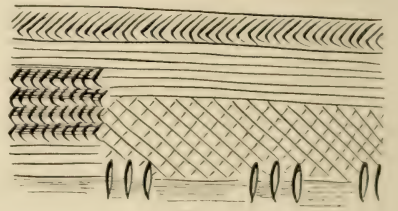
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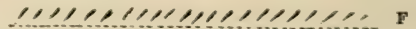
D



E



F



F

INCISED DESIGNS FROM POTTERY VESSELS

a, b, and d, designs from Iroquoian vessels; *c* and *e,* designs from an Algonkian vessel; *f,* design from a vessel of the Iroquoian type from a Connecticut rock-shelter, introduced here for comparison.

Pottery is found abundantly on the majority of the sites in this district; but, while very much more common than in the New England area, it does not equal in abundance that from the Iroquois country. It is rarely found buried in graves with skeletons as in the Iroquoian area; when sometimes found in graves, however, it is usually at some distance from the human remains and apparently not connected with them. Whole or nearly whole vessels are exceedingly rare and the number of those found up to date may easily be counted upon the fingers. Potsherds taken from pits or shell-heaps, where they have not been exposed to the action of the weather, are often as thickly covered with grease as when they were broken and cast aside.

ARTICLES OF METAL.

Beads. Beads of native metal, consisting simply of pieces of hammered sheet copper rolled into small tubes, have been found, but they are very rare. Copper salts, but no objects, were found upon the bones, especially on those of the head and neck of a child's skeleton at Burial Ridge, Tottenville, Staten Island, which seemed to predicate the use of copper beads. A great many beads of *olivella* shell, some of them discolored by copper salts, were found about the neck of the skeleton. A single celt of copper is said to have been found in Westchester County, probably on Croton Neck, slightly above the limit of the territory treated in this paper.¹ A large number of copper beads of the type described were found with a skeleton on Constable Hook, Bayonne, New Jersey, and are now in the hands of a private collector in Brooklyn.

ARTICLES OF SHELL.

Wampum. Objects of shell are not at all common, notwithstanding that the coast region of New York was one of the best known localities for wampum manufacture on the continent. Wampum beads are almost unknown from local sites. With the exception of completed beads, most of which may have been taken into the interior, by the Indians, wampum may be found in all stages of manufacture. We refer to the white wampum, for traces of the "black" (blue) wampum made from the hard clam or quahog are so far not reported. The process of manufacture may be shown by shells with the outer whorls broken away in steps until the innermost solid column is reached, ground and polished at the end, and needing only cutting off into sections and per-

¹Native copper occurs in the New Jersey trap ridges within a few miles of New York City, an important source in Colonial times being near Boundbrook, 30 miles from the lower end of Manhattan Island. Boulders of native copper occur in the glacial drift.

forations to make the finished white wampum bead. These do not occur on all sites, though they have been found here and there throughout the region. Ninety-six conch shells with the outer whorls broken entirely away were found in a grave at Burial Ridge, Tottenville, Staten Island, about the head and neck of a skeleton.

Pendants. Occasionally oyster and clam shells, found unworked save for perforations in them, may have been pendants or ornaments, but certainly have little æsthetic value.

Scrapers. Clam shells seem to have been used as scrapers and some are occasionally found with one edge showing the effect of rubbing and wearing. These are rare, however. Some may have been pottery smoothers. Clam shells have been reported which contained central perforations and were identical in appearance with some shell pottery scrapers and smoothers collected by Mr. M. R. Harrington among the Catawba. Contemporary writers mention the use of knives made of shell.

Pottery Tempering. This was sometimes done with calcined and pounded shells, but was uncommon, considering the abundance of the material at hand. Pounded stone or gravel seems to have been more favored.

Pottery Stamps. The corrugated edge of a scallop shell was frequently used as a stamp for pottery, as may be seen by examining the potsherds from this region.

ARTICLES OF BONE AND ANTLER.

Objects of bone and antler, while perhaps more abundant here than in New England, are far less plentiful in form and number than in the Iroquoian area. Cut bones are frequent in most shell pits and heaps. They were cut probably with a flint knife, by grooving the bone partly through on all sides, and breaking.

Bone Awls. These utensils are the most common of all bone articles in this region and are found in almost every part of the area. Some are merely sharpened slivers, but others show a considerable degree of work, and are well finished and polished. They are usually made of deer or other mammal bone, but sometimes from the leg bones of birds.

In some instances, the joint of the bone is left for a handle, but this is often cut off. Grooved, perforated, or decorated bone awls are extremely rare in this region. While it is generally considered that these bone tools were used as awls in sewing leather, as by modern shoemakers, nevertheless, they may have served as forks in removing hot morsels from the pot

or for a number of other purposes. The latter supposition is supported by the abundance of bone awls found in some shell pits. The Eastern Cree of the Hudson Bay region use a similar bone implement as the catching or striking pin in the cup-and-ball game.

Bone Needles. These are rare, but found in most localities. They are generally made of the curved ribs of mammals and are six or eight inches long, or even longer. They are generally broken across the eye, which is usually midway between the ends. A few with the perforation at one end have been reported.

Bone Arrow Points, usually hollow and conical in shape, have been found, especially at Tottenville, Staten Island, in the Burial Ridge. They are rather rare, but this may be due to the fact that conditions are not suitable for their preservation in most localities. Others are flat and triangular in shape.

Harpoons. No actual barbed bone harpoons, such as occur in the Iroquois country, have been reported from this region; although the writer has seen what appeared to be part of one from Shinnecock Hills, Long Island, whence comes a harpoon barb of bone found by the writer, now in the Museum collection, which was apparently made to tie to a wooden shaft. While neither of these forms seems to occur within this region, several naturally barbed spines from the tail of the sting-ray, found on the Bowman's Brook site, at Mariner's Harbor, Staten Island, may have been used as harpoons or fish spears, for which purpose they were admirably suited by nature. Long, narrow, chipped stone arrow-heads are generally called "fish points" but they do not seem peculiarly adapted for this purpose and the name is probably a misnomer. No bone fish hooks are reported from hereabouts, though suggested by early writers.

Bone Beads and Tubes. While so abundant on Iroquoian sites, tubes and beads made of hollow bird or other animal bones, polished and cut in sections, are very rare here.

Draw Shaves, or Beaming Tools, made of bone, and probably used for removing the hair from skins, were made by splitting the bone of a deer's leg, leaving a sharp blade in the middle with the joints on either end as handles. The writer has seen none from this immediate region, but they are reported by Mr. M. R. Harrington. A number were obtained for the Museum by Mr. Ernest Volk in the Lenapé sites near Trenton, New Jersey. An implement, evidently made of the scapula of a deer, and perhaps used as a scraper, was found in a grave at Burial Ridge, Tottenville, Staten Island, by Mr. George H. Pepper.

Worked Teeth. Perforated teeth of the bear, wolf, and other animals, so abundant on Iroquoian sites, never seem to be found here. Beavers' teeth cut and ground to an edge, occur, and may have been used as chisels, or primitive crooked knives, or both, as they were till recently by some of the eastern Canadian Algonkin. Other cut beaver teeth may have served as dice or counters in gaming.

Turtle Shell Cups. These are common, and consist merely of the bony carapace of the box turtle (*Terrapene carolina*), scraped and cleaned inside, the ribs being cut away from the covering to finish the utensil for use.

Antler Implements. Deer antlers and fragments of antler, worked and unworked, occur in all shell-heaps and pits. When whole antlers are found, they usually show at the base the marks of the axe or other implement used to detach them from the skull. Cut antler prongs, prongs broken from the main shaft and others partly hollowed and sharpened show the process of manufacture of antler arrow points. These are characteristic of this area and are usually conical in shape, hollowed to receive the shaft, and with one or more barbs; not infrequently, however, they are diamond-shaped in cross-section. The shaft fitted into the hollow socket as in the case of the conical bone arrow points. A large number were found in and among the bones of human skeletons in a grave at the Burial Ridge, Tottenville, Staten Island.

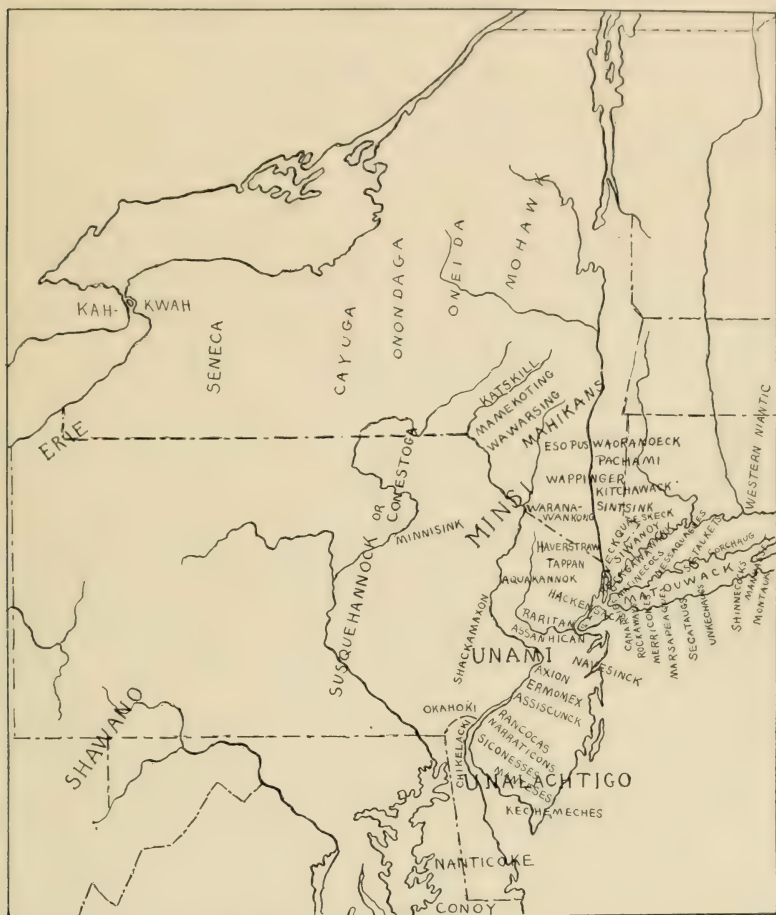
Cylinders, neatly cut and worked all over, or cylindrical tines made of deer antler cut and rounded only at the ends, are not infrequent, and were probably used as flaking tools in making and finishing arrow points by pressure. One broken cylinder or pin, found on the Bowman's Brook site, Mariner's Harbor, Staten Island, had a rounded, neatly carved head. This specimen, however, seems to be unique.

Pottery Stamps, perhaps of antler or bone but which may be of wood, seem to have been used, judging by the decorations of many pottery sherds. A pottery stamp, carved from antler, was found slightly east of this region, at Dosoris, Glen Cove, Long Island, by Mr. M. R. Harrington, and is now in the Museum collection.

TRADE ARTICLES.

In spite of the frequent mention by old writers of barter of European for Indian goods, the amount of trade material found is small indeed. While it is abundant in the Iroquoian area, all that has ever been found here consists of a few round-socketed iron tomahawks, iron hoes, brass or copper arrow points of various styles, a little porcelain, a few glass beads,

Venetian and plain, and some old pipes, notably those stamped "R. Tippet" on the bowl. All these articles are very rare here, and for this no adequate explanation can be given.



LOCATION OF THE NEW YORK COASTAL ALGONKIN AND THEIR NEIGHBORS

RESUMÉ.

The area treated of in this paper was inhabited during historic times by the following tribes:¹

¹On the map above, these tribes are shown together with the Long Island and other neighboring tribes as indicated by Beauchamp in the map accompanying his "Aboriginal Occupation of New York," New York State Museum, Bulletin 32, Albany, 1900.

A. The Lenni Lenapé, or Delaware, ranging from the Raritan River, including Staten Island, to Saugerties on the west bank of the Hudson.

Raritan or Assanhican.

Hackensack.

Tappan.

Aquakanonk.

Haverstraw.

Waranawankong.

B. The Wappinger Confederacy ranging along the east bank of the Hudson, eastward to Connecticut, from Manhattan Island.

Rechgawawank or Manhattan.

Siwanoy.

Weckquaskeek.

Wappinger.

C. Montauk or Matouwack Confederacy.

Canarsie.

These tribes were surrounded on all sides by neighbors of the same stock, who differed somewhat in their language and culture. On the south and west lay the Lenni Lenapé, or Delaware proper, on the north the Mahikan, and on the east the New England tribes. Almost without exception, these natives were displaced early in the history of this country, and have been long since expatriated or exterminated. A very few mixed bloods may yet be found on Staten Island, Long Island, and in Westchester County, but their percentage of Indian blood is extremely low.

The remains of aboriginal life now to be found consist of shell-heaps, occurring at every convenient point along the coast, on the rivers, and, more rarely, inland; shell, refuse, and fire pits; camp, village, and burial sites; and rock and cave shelters. With one prominent exception,¹ few or no relics have been found in graves. The typical interment was of the flexed variety. Bone burials, also, are not infrequent.

Dog skeletons, complete and intact, bearing the appearance of having been laid out, are sometimes found buried in separate graves. Some writers have supposed that these individual dog burials are the remains of "white dog feasts" or kindred practices, because the Iroquois even up to the present day hold such ceremonies. The white dog is entirely cremated by the Iroquois, and so far as we have been able to find out,

Burial Ridge, Tottenville, Staten Island.

there is no record of such occurrences among the Coastal Algonkin; hence, there seems no reason to attribute this custom to them since other Iroquois traits were so infrequent. It seems more probable that such burials are simply those of pet animals, interred as we today honor a faithful dog.

Some of these dog burials may have been sacrifices made to the Underneath Powers, such as horned snakes, just as is the practice of the western Indians today.

In Waessenauer's *Historie Von Europe*, we read of the Mahikan who lived on the Upper Hudson.

It appears that the *Sickanamers* before-mentioned, make a sort of sacrifice. They have a hole in a hill in which they place a kettle full of all sorts of articles that they have, either by them, or procured. When there is a great quantity collected a snake comes in, then they all depart, and the Manitou, that is the Devil, comes in the night and takes the kettle away, according to the statement of the *Koutsinacka*, or Devil hunter, who presides over the ceremony.¹

* * * * *

Our Indians may well have sacrificed dogs and buried them for these mythical snake monsters.

Occasionally, the skeletons of dogs and rarely of other animals have been found in graves associated with human bones. The finding of arrow-heads among the ribs of some of these, and other circumstances, seem to point to a practice of killing a favorite animal on the death of its owner to accompany or protect the spirit of its master on the journey to the hereafter.

From their appearance and position, many graves seem to indicate that the dead may sometimes have been buried under the lodge, especially in winter, when the ground outside was frozen too hard to permit grave digging. Others under the same circumstances seem to have been buried in refuse pits. The remains further indicate that "feasts of the dead" were also held at the time of the interment, judging by the quantity of oyster shells and animal bones in and near the graves. Some graves have rows or layers of oyster shells, with the sharp cutting edge upward, placed above the bodies as if to prevent wild animals from disinterring and devouring the dead.

An interesting fact, brought to light by the rock-shelter work of Messrs. Schrabisch and Harrington in their explorations in New Jersey and in Westchester County, New York, is that in the lowest and oldest refuse layers of some of these shelters pottery does not occur. It would

¹Documentary History of New York, Vol. III, p. 46.

be ill advised to infer from this that the earliest occupants were peoples of another culture from the surrounding village dwellers, as the other artifacts found are quite similar to the implements of the latter. Many reasons for this lack of pottery, such as the more easy transportation of vessels of bark or wood through the mountains and hills, suggest themselves, though they are more or less nullified by the presence of pottery in the upper layers. The upper layer, however, may have been made during the period when the natives were being displaced by Europeans and at the same time subjected to Iroquoian raids, when the villages would naturally be abandoned from time to time, for refuge among the cliffs and caves of the mountain fastnesses.

It has been suggested that the rock and cave shelters are remains of an older occupation by people with or without the same culture as the later known savages. The nature of the finds does not support this view, for the specimens obtained are often of as good workmanship as the best to be found in the villages and cemeteries of the latter, while pottery, on the other hand, occurs on the oldest known Algonkian sites. It seems most probable to the writer that, like the shell-heaps, the rock and cave shelters form but a component part, or phase, of the local culture, perhaps a little specialized from usage and environment, but contemporary with the villages, shell-heaps, and cemeteries of the lowlands.

Mounds and earthworks do not occur in the region under consideration, nor does it appear that most of the Indian villages here were fortified, unless they were slightly stockaded. A number of instances of this are known historically, however, and a few earthworks occur just beyond this area.¹

The remains found do not bear any appearance of very great geological antiquity. In a few instances, rock-shelters, shell-heaps, and village sites seem to possess a relative antiquity; but the oldest known remains, in every case, may be placed as Algonkian with considerable certainty. No paleoliths have been reported, and it would seem from the comparative lack of antiquity of the remains that the natives could not have lived in this region for many centuries before the advent of the whites. The accounts of contemporary writers prove conclusively that these archaeological remains, if not those left by Indians found here by the early Dutch and English settlers, must have been from people of very similar culture. In culture, the local Indians were not as high as the Iroquois, nor perhaps as the Lenapé or Delaware proper to whom they

¹An earthwork at Croton Point on the Hudson has been excavated by Mr. M. R. Harrington for the American Museum.

are related; but they compare very favorably with the New England tribes. Absence and scarcity of certain artifacts, such as steatite vessels, the long stone pestle, the gouge, adze, and plummet, and the abundance and character of bone and pottery articles show them to have been intermediate in character between the Lenapé on the south and west, and the New England tribes on the east and north; and consultations of the old European contemporaries show that this was the case linguistically as well as culturally. Examination of the remains also shows that the influence of the Lenapé on the west, and of the New England peoples on the east, was most strongly felt near their respective borders. Iroquoian influence was strong, as evinced by the pottery, and there is also documentary evidence to this effect. Finally, as is frequent throughout most of eastern North America, the archæological remains may be definitely placed as belonging to the native Indian tribes who held the country at the time of its discovery or to their immediate ancestors.

ABORIGINAL REMAINS ON MANHATTAN ISLAND¹

THE first field work done on Manhattan Island is of very recent date. Doubtless many articles of Indian manufacture and evidences of Indian occupation were found as the city grew up from its first settlement at Fort Amsterdam, but of these specimens we have very few records. An arrow point found in the plaster on the wall of a Colonial house was, without doubt, in the hands of some member of the Kortrecht family; and Indian pottery has been found in a hut occupied by Hessian soldiers during the War of Independence. The first specimens to have been preserved, to the knowledge of those now interested in the subject, were found in 1855, and consisted of Indian arrow points discovered in Harlem during excavation for a cellar on Avenue A, between 120th and 121st Streets. Some of these are spoken of by James Riker² as being in the author's cabinet. Riker also speaks of shell-heaps near here.³ The next specimens preserved were found at Kingsbridge Road (now Broadway) and 220th Street in 1886, and are in the John Neafie collection at the Museum. These consist of an arrow point and a few bits of pottery. The next work was begun in 1889 by Mr. W. L. Calver

¹By James K. Finch, revised by Leslie Spier.

²History of Harlem (1881), footnote, p. 137.

³Ibid, p. 366.

of this city, and has led to the discovery of much valuable material which has been preserved.¹

The following account of the work is taken mainly from Mr. Calver's notebook:

In the autumn of the year 1889, while exploring the heights of Bloomingdale (now called Cathedral Heights) for any relics that might have remained from the Battle of Harlem, Mr. Calver discovered one arrow point at 118th Street, east of Ninth Avenue, and immediately afterwards a circular hammerstone. On a later trip to the same locality, he found a small grooved axe or tomahawk. In February, 1890, while hunting for Revolutionary relics in the vicinity of Fort Washington, he made a trip to the northern part of the island in search of British regimental buttons, many of which were said to have been found in that vicinity. There he met an old acquaintance, Mr. John Pearce, a policeman then on duty there, by whom he was introduced to Mr. James McGuey, a youth residing in the vicinity of 198th Street and Kingsbridge Road, and, while crossing the orchard at Academy Street and Seaman Avenue, Mr. Calver saw that the ground was thickly strewn with shells which afterwards proved to be of Indian origin.

The first Sunday in March, Messrs. Calver and McGuey explored this part of the Island for Indian remains. At the junction of Academy Street and Prescott Avenue, they found an Indian potsherd the importance of which Mr. McGuey seemed to realize, for, a week later, Mr. Calver met him again and was presented by him with a number of fragments of Indian ware. He assured Mr. Calver that he had found them by digging in an Indian graveyard. The two men dug again at this place, and found more pottery. They then went to Cold Spring, a point on the extreme northern end of the Island, and in a shell-heap there they found more Indian work. Mr. Alexander C. Chenoweth, an engineer then on the Croton Aqueduct, hearing of these discoveries, obtained a permit from the property owners and began to explore "The Knoll," at Dyckman Street and Broadway, for Indian remains. After having finished here, he went to Cold Spring and made some further discoveries. All his specimens were purchased in 1894 by the Museum, and some of them are now on exhibition.

¹In the Spring of 1890 Mr. Edward Hagaman Hall began his investigations and at about the same time Mr. Reginald Pelham Bolton entered the field of local research. In many instances these gentlemen and Mr. W. L. Calver collaborated with valuable results. In the preservation of the traces of Indian occupation of Manhattan Island the American Scenic and Historic Preservation Society (formed in 1895 under the presidency of the late Hon. Andrew H. Green, but now under that of Dr. George Frederick Kunz) has done much pioneer work.

Since this time, several interesting relics have been found, and as the work of grading streets and other excavation at this part of the Island are carried on, more relics will probably come to light.

The only Indian remains left on the Island, so far as known to the writer, are situated at the extreme northern end at Inwood and Cold Spring. They consist of the so-called shell-heaps or refuse piles from Indian camps, and three rock-shelters at Cold Spring. But we have evidence to show that this was not the only part of the Island occupied by the Indians. Mrs. Lamb¹ says that the Dutch found a large shell-heap on the west shore of Fresh Water Pond, a small pond, mostly swamp, which was bounded by the present Bowery, Elm, Canal, and Pearl Streets, and which they named from this circumstance Kalch-Hook. In course of time, this was abbreviated to Kalch or Collect and was applied to the pond itself.² This shell-heap must have been the accumulation of quite a village, for Mrs. Jno. K. Van Rensselaer³ speaks of a castle called Catiemuts overlooking a small pond near Canal Street, and says that the neighborhood was called Shell Point. Hemstreet refers to the same castle as being on a hill "close by the present Chatham Square," and says that it had once been an "Indian lookout."⁴ Excavations at Pearl Street are said to have reached old shell banks. "The Memorial History of New York"⁵ says that a hill near Chatham Square was called Warpoes, which meant literally a "small hill."⁶ According to the same authority, "Corlear's Hoeck was called Naigianac, literally, 'sandlands.' It may, however, have been the name of the Indian village which stood there, and was in temporary occupation." This is the only reference we have to this village, but there are references to another on the lower end of the Island. Janvier⁷ says that there was an Indian settlement as late as 1661 at Sappokanican near the present Gansevoort Market. According to Judge Benson,⁸ Sappokanican ("tobacco field")⁹ was the Indian name for the point afterwards known as Greenwich. "In the Dutch records references are made to the Indian village of Sappokanican; and this name * * * was applied for more than a century to the region which came to be known as Greenwich in the later, English, times. The Indian village probably was near the site of the present Gansevoort Market;

¹History of New York City, p. 36.

²Mr. Edward Hagaman Hall, however, derives the name from "Kolk" or "Kolch," a word still in use in Holland and applied to portions of a canal or inclosure of water.—Editor.

³Goede-Vrouw of Manahata, p. 39.

⁴Hemstreet, Nooks and Corners of Old New York, p. 46.

⁵Bulletin, N. Y. State Museum, Vol. 7, No. 32, p. 107, Feb., 1900.

⁶James G. Wilson, *op. cit.*, p. 52.

⁷Evolution of New York.

⁸N. Y. Historical Society Collections, S. II, Vol. II, Pt. I, p. 84. 1848.

⁹All Hilse translations are doubtful.

but the name seems to have been applied to the whole region lying between the North River and the stream called the Manetta Water or Bestavaar's Kill.¹ Benton says that the name of the village was Lapinean.² Going back to the old Dutch records might lead to finding the actual names and other data regarding these places.

Most of the specimens found on Manhattan Island, as already stated, come from the northern part. We have a few from the central portion, however. There are the arrow-heads spoken of by Riker, and in the Webster Free Library there is a fine specimen of a grooved stone axe found at 77th Street and Avenue B. Mr. Calver has found an arrow-head at 81st Street and Hudson River and specimens from the site of Columbia College have been recorded.

Doubtless the northern part of the Island was inhabited for the longer period; but it is probable that all along the shore, wherever one of the many springs or small brooks, shown on old maps, emptied into the Hudson or East River, there were small, temporary Indian camps. It is likely that these camps were used only in summer, while the primitive occupant of Manhattan retreated to the more protected part of the Island, as at Inwood and Cold Spring, during the winter. Or it may be possible that, as Ruttenber³ states, the villages on Manhattan Island were only occupied when the Indians were on hunting and fishing excursions, while their permanent villages were on the mainland. Bolton,⁴ however, says their principal settlement was on Manhattan Island.

Fort Washington Point. There is a small deposit of shells on the southern edge of the point, in which the writer found some small pieces of pottery and a few flint chips, thus proving its Indian origin. This was probably a summer camp, as it was too exposed for winter use.

Zerrenner's Farm. A favorable sloping field at 194th Street and Broadway now used for truck farming, was utilized as a camp site. Camp débris of varied character has been plowed up here. Perhaps the overhanging rocks below Ft. Washington, between 194th and 198th Streets on Bennett Avenue, afforded the Indians some shelter in winter.

Inwood Station Site. At the foot of Dyckman Street and Hudson River, there existed a large deposit of shells, most of which were removed when the rocks on which they lay were blasted away for grading the street. A few arrow points and bits of pottery, as well as several Revolutionary objects, were found here. There are photographs of this deposit in the Museum.

¹Thos. A. Janvier, in *Old New York*, pp. 85-86.

²New York, p. 26.

³Indian Tribes of Hudson's River, p. 78.

⁴History of Westchester County, p. 25.

Seaman Avenue Site. This site, between Academy and Hawthorne Streets, running through from Seaman Avenue to Cooper Street, is the most extensive village site from which remains have been collected. It was a British camp site during the Revolution, and a number of buttons, gun-flints, and bullets have been found there, as well as numerous Indian remains. It seems to have been the workshop for a red jasper-like stone of which numerous chips but no finished implements have been found. The shells at this point were first noticed by Mr. Calver in 1890. They may not all be of Indian origin, as some may be due to Revolutionary soldiers.

Harlem River Deposit. Mr Calver says, "Extending from 209th Street to 211th Street on the west bank of the Harlem River and almost on a line with Ninth Avenue was another large deposit of oyster shells lying just beneath the top soil of the field. These shells had nearly all been disturbed by the plow and were interesting only for their color, which was red. Pieces of horn of deer and split bones of the same animal were common among the shells; but, in spite of the apparent antiquity of the deposit, there were, even in the lowest strata of it, some small fragments of glass, which proved that either the whole mass had been disturbed or else the shells had been left during the historic period. There are several stone sinkers and hammerstones from this spot in Mr. Calver's collection and at the Museum.

Isham Park Site. On the knolls along the south side of Isham Park, and particularly in Isham's Garden, about on the line of Isham Street and Seaman Avenue, the soil is white with small fragments of shells. A number of arrow points, flint chips, hammerstones, sinkers, and potsherds have been found here. On the knolls to the south of this garden, an Indian burial, shell pockets with small deposits of pottery, etc., and several dog burials, have been found. There are two small shell-heaps, containing chips and potsherds, in the Park on the bank of the Ship Canal, and several shell pockets were disturbed in excavating 218th Street on the north side of the Park.

Cold Spring. Cold Spring is situated at the extreme northern end of Manhattan Island on the southern shore of Spuyten Duyvil Creek. The Indian remains consist of three rock-shelters and three refuse heaps. The rock-shelter is a formation where the overhanging rocks form a small cave or shelter which the Indians used as a dwelling place. All their rubbish, such as oyster shells, broken pottery, and broken arrow-heads, were dumped near by, forming the so-called shell-heaps. Messrs. Calver and McGuey explored the shell-heaps; but Mr. Chenoweth was the first to

suspect the existence of the shelters. There is only one which is likely to have been used as a dwelling place, the others being places where food was stored or shelters for fires used in cooking. These shelters face east, and are at the foot of Inwood Hill (formerly called Cock Hill), which forms the most northern part of Manhattan Island. The largest one was formed by several of the rocks breaking off the cliffs above and falling in such a manner that, by digging out some of the earth from beneath them, the Indians could make a small shelter. Probably it was occupied by one family, while the others lived in bark wigwams near by.¹ Another of the shelters is simply an excavation under the end of a huge fragment which also dropped from the cliffs above, and the third is a large crevice in the foot of these cliffs. When Mr. Chenoweth first explored them, all these shelters were completely filled with earth which had gradually worked its way in since their occupation, and much credit is due him for suspecting their presence. In them he found fragments of pottery and stone implements, together with the bones of turkey and deer. The largest of the refuse heaps is situated on a rise directly in front of these shelters. It consists of a layer of shells, in places one foot thick, found under a layer of fine loam, a black earth which has been deposited since the shells were scattered over the original sandy yellow soil. The sheltered position of this place made it an especially desirable camp site. The hills to the south and west formed a protection to the camp from winds, and by Spuyten Duyvil Creek access could be had to either Hudson or East River; while the Cold Spring, from which the place takes its name, furnished an abundant supply of fresh water.

Harlem Ship Canal. Formerly at 220th Street and Kingsbridge Road was a large deposit of shells on the westerly side of the road. This was destroyed when the ship canal was put through. As with the Inwood Station site, no systematic examination of this place was ever made. Mr. John Neafie found some potsherds here in 1886. Mr. Chenoweth also has some potsherds from here.² Mr. Calver says that this was a large deposit, and that the peculiar thing about it was that the shells were so wedged and packed together that a pick would hardly penetrate them. They lay on the bare rock surface in cracks in the rock; a condition common to this neighborhood.

Shell Pockets at 211th Street. In March, 1903, there was considerable excitement over the reported discovery of an Indian graveyard at 211th Street.³ The graveyard proved to have been that of some slaves, and was

¹Memorial History of New York, Vol. I, p. 33, for picture of houses, and p. 30 for description.

²John Neafie collection, 20-2558; Chenoweth, 20-3498.

³Evening Telegram, March 14, 1903.

situated on the western end of the rise between 210th and 211th Streets, on the eastern end of which is the old Neagle Burying Ground. This discovery was interesting because under the negro graves several shell pockets of undoubted Indian origin came to light. The workmen, in grading Tenth Avenue, cut into this hill to obtain material for filling, and uncovered the graves and pockets. It seems almost certain that the deposits were made some time ago; then the wind blew the sand over the deposits to a depth of four or five feet, and negroes later used this place as a burial ground. In support of this theory is the fact that the pockets were four or five feet under the surface, that the soil above showed no signs of having been disturbed, and that this rise is put down on the Government maps of this section as a sand dune.¹ During the summer of 1904, Mr. Calver with Messrs. Hall and Bolton uncovered nine or more pockets to the southwest of the graveyard.² These pockets all seem to have been of the same period as the others, and all appear to have been on the original ground surface, although those farther up the hill were some four feet under the present surface. In one of these pockets was found the complete skeleton of a dog,³ in another, a turtle shell; two others contained complete snake skeletons; while a fifth held the fragments of a small pottery vessel. The pockets were small, being about three feet in diameter and of equal depth, showing no signs of having first been used as fireplaces and then filled up, though charcoal was scattered among the shells. Almost all the relics from Van Cortlandt Park were found by Mr. James in pockets similar to these.

During Indian troubles in 1675, the Wickquaskeek at Ann's Hook, now Pelham Neck, were told "to remove within a fortnight to their usual winter quarters within Hellgate upon this Island." River says, "This winter retreat was either the woodlands between Harlem Plains and Kingsbridge, at that date still claimed by these Indians as hunting grounds, or Rechawanes and adjoining lands on the Bay of Hellgate, as the words 'within Hellgate' would strictly mean, and which, by the immense shellbeds found there formerly, is proved to have been a favorite Indian resort."⁴ A little later the Indians asked to be allowed to return to their maize lands on Manhattan Island and the Governor said that they, "if they desire it, be admitted with their wives and children, to plant upon this Island, but nowhere else, if they remove; and that it be upon the north point of the Island near Spuyten Duyvel."⁵

¹New York Geologic Folio.

²New York Tribune, Oct. 30, 1904, and New York Sun, Dec. 14, 1904.

³All that could be saved of this skeleton has been presented to the Museum by Mr. Edward Hagan-Hall.

⁴History of Harlem, p. 366.

⁵History of Harlem, p. 369.

Mrs. Mary A. Bolton Post, in writing to the editor of "The Evening Post," June 19th of the year of the opening of the Harlem Ship Canal (1895), speaks of some Indians who were allowed to camp on the south side of Spuyten Duyvil Creek on the Bolton property in 1817. Ruttenber says that the Reckgawane had their principal village at Yonkers, but that on Berrian's Neck (Spuyten Duyvil Hill) was situated their castle or fort called Nipinichsen. This fort was protected by a strong stockade and commanded the romantic scenery of the Papirinimen, or Spuyten Duyvil Creek, and the Mahicanituk (Hudson River), the junction of which was called the Shorackappock. It was from this castle that the Indians came who attacked Hudson on his return down the river.¹ Some small shell deposits occur on Spuyten Duyvil Hill, but as yet this "castile" has not been definitely located. The village site at Yonkers, according to Mr. James, is now covered by buildings; but several relics found near the site years ago are now in the Manor Hall at that place (1904).

Judging from these references, we might conclude that the territory occupied by the tribe commonly known as Manhattan included Manhattan Island and that part of the mainland which is west of the Bronx River south of Yonkers, and that these Indians were a sub-tribe of the Wappinger division of the Mahikan.

NOTABLE TYPES OF REMAINS.

Dog Burials. The first dog burials were found by Mr. Calver in 1895. The first burial was unearthed at the summit of a ridge of soft earth at 209th Street, near the Harlem River. The ridge, which was about twelve feet high, had been partly cut away for the grading of Ninth Avenue. It was at the highest part of the hillock that a pocket of oyster and clam shells was noticed, from which a few fragments of Indian pottery which lay on the face of the bank had evidently fallen. The shells, upon inspection, were found to have served as a covering for the skeleton of a dog or wolf. Another burial was found on May 18th within fifty yards of the first burial. It had been covered with shells just as the first one, but had been disturbed by workmen. Mr. Calver says: "The two canine burials were situated at a point just without the borders of the Harlem River shell-heap and were distinct from it. The shells were found to be matched, hence it was concluded that they were thrown in unopened or eaten on the spot. As the skeletons were intact

¹Ruttenber, pp. 77-78.

and the bones uninjured, all probability of the animals having been eaten is disposed of." These burials are common in this vicinity; Mr. Calver thinks they were for some religious purpose, and suggests a relation to the "White Dog Feast" of the Onondaga of this state.¹ However, it is known that the carcass of the sacrificed dog was burnt by the Iroquois and the explanation given on page 46 is probably correct.



INDIAN BURIAL, MANHATTAN

Indian Burials. Notwithstanding all the efforts of various collectors, the first Indian burials to be discovered on the Island were due to the activities of Messrs. Bolton and Calver in 1904. The improvement of Seaman Avenue, Inwood, at that time, uncovered many relics of the long extinct Indian inhabitants, among which Mr. Bolton saw unmistakable signs of Indian graves. To quote from this gentleman: "It thus became evident that there were human interments in the vicinity, and in August, 1907, the first burial was discovered under a shell pit in Corbett's garden. The grading process had been extended only about eighteen inches below the sod, but had sufficed to destroy the jaw of the

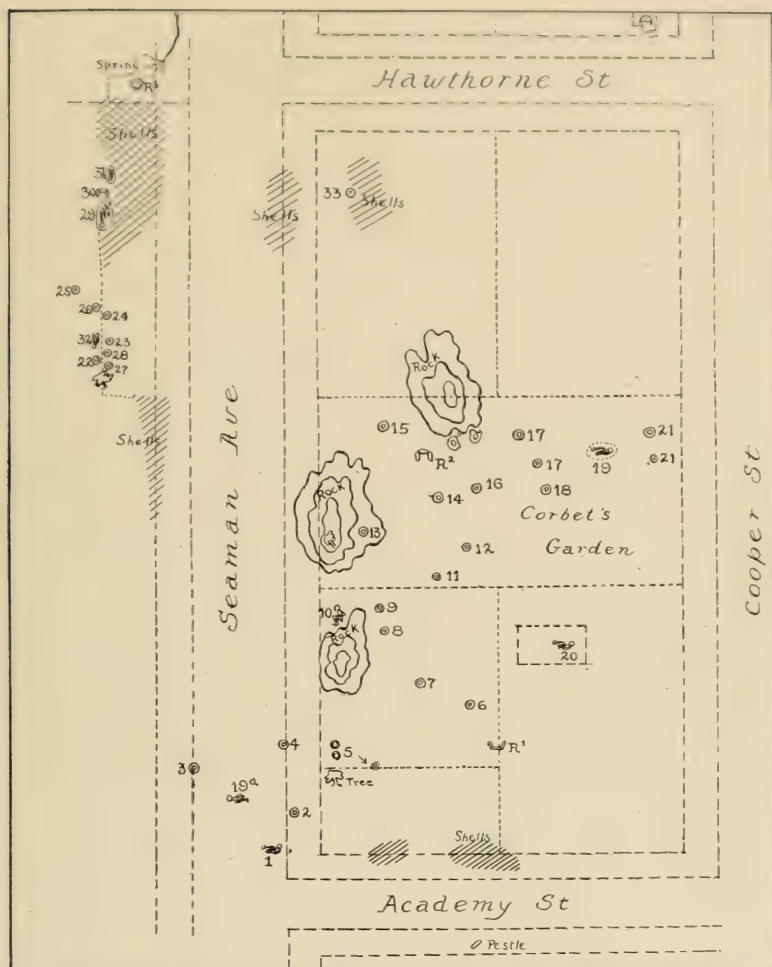
¹New York Herald, May 26, 1895.

skeleton which extended upwards, as did also the foot bones. The bones lay in and upon a close mass of oyster shells, some of which were unopened. The skeleton reclined on its right side, facing west. The arms were flexed and crossed, the knees bent and the head thrown back. No traces of weapons were found, nor were there any other objects found, save a fragment of an animal bone.

"The location and position led to further exploration which early in 1908 led to still more interesting discoveries. Sunday, March 22nd, being the first day in the field for exploration for the season for 1908, W. L. Calver and the writer met at Seaman Avenue and Hawthorne Street, Manhattan, to discuss plans for further excavations on this Indian village site. The rains of the winter 1907-8 had washed the west bank where the layer of oyster shells and black dirt lay along the hill, and a patch of red burnt earth was observed, which on digging out, disclosed a fireplace, evidently of the period of the Revolution, having some large burnt stones, ashes, wood charcoal, brick, broken rum bottles, a wine glass nearly complete, a large open clasp-knife with bone handle, a hoop-iron pot-hook, various forged head nails and a curious folding corkscrew. Gold buttons of Revolutionary pattern and an officer's silver button of the Royal Marines, together with pewter buttons of the 17th Regiment, disclosed who had occupied the spot.

"At one part of this fireplace, we came upon a pocket of oyster shells, evidently Indian, about two feet deep, and on removing some of these, had the good fortune to uncover a human thigh-bone. We worked carefully into the shells and under the pocket, gradually disclosing the complete remains of a full-grown man lying on its right side, feet to the north, head facing east, knees doubled up, the left arm extended down through the thighs. The feet had been within the area of the hole in which the Revolutionary fireplace had been made, and only one or two foot bones were found. At a later period other foot bones were found on the opposite side of the Revolutionary fireplace, evidently having been displaced in its construction. The right arm was flexed, and the hand was under the head, the latter was intact and every tooth was in place. Shells had been packed over the body, and some around it. We were much puzzled by a number of human bones lying compactly together by the skeleton, in a position that would have been in its lap, had it been upright.

"We removed the skull, covered the remains, and on Sunday, March 29th, renewed the work. We went carefully to work upon the cluster of mixed bones in front of the large skeleton, and soon found them to be



LOCATION OF BURIALS, PITS AND SHELL-BEDS NEAR INWOOD

1. Human remains. 2. Shell pit, deer antler. 3. Shell pit. 4. Shell pit, pottery. 5. Shell pits. 6. Shell pit, sturgeon below. 7. Shell pit, sturgeon scales. 8, 9. Shell pits. 10. Human remains. 11. Fire pit. 12. Shell pit. 13. Dog burial, puppy. 14. Shell pit. 15. Part of a jar. 16. Shell pit, fish and meat bones. 17. Shell pits. 18. Two dogs in shell pit. 19. Human skeleton, 1907. 19a. Female skeleton, 1908. 20. Human remains when house was built. 21. Small fire pits, Revolutionary. 22. Large shell pit. 23. Large shell pit. 24. Shell pit. 25. Dog burial. 26, 27, 28. Shell pits. 29. Two human skeletons, male and female. 30. Revolutionary fireplace "Royal Marines" and "17th." 31. Skeleton and infant, female. 32. Skeleton (Chenoweth, 1908). 33. Revolutionary fireplace. 71st, officers' buttons. D. Dyckman dwelling. R¹, R². Revolutionary fireplaces. R³. Revolutionary well.

rather compactly arranged in a rectangular form about 14 by 26 inches, the long bones parallel. The vertebrae abruptly ended parallel with the head of the larger skeleton, and after working some time, we found a skull placed below, beneath the pile of bones in a vertical position, facing north, the lower jaw of which was disengaged, and was placed sideways in front of the face. The back of the skull was broken in, and was black with marks of burning. The lower jaw was burned, and some of the teeth split by fire. The arm and leg bones were charred at the joints. Inside the skull was a burned toe bone. There were some oyster shells among the charred remains.

"A significant fact was that the right arm bones of the large skeleton were below the pile of burned bones. This feature, and the compact arrangement of the latter within the space in front of and at the same level as the large skeleton, seem to point strongly towards an intentional arrangement of these bones, in front of the large corpse and to indicate the simultaneous burial of the two bodies. On examination, the large skeleton proved to be that of an adult male, and the dismembered remains those of a female of about 35 years of age. No implements were found with the remains, but a part of a stone pestle and a rude celt lay under the sod among the oysters above the large skeleton.

"On Sunday, June 14, 1908, another burial was found about 20 feet north of the above. This burial consisted of an adult skeleton doubled up and its back much curved, and was apparently that of a female of mature age. Between the knees, the remains of a small infant were laid, the skull of the latter being fragmentary. The right hand of the adult was below the infant and the left hand around the throat. The skull was intact and had nearly all the teeth. One finger bone had grown together at the joint in a crooked position apparently due to disease. On lifting the ribs of the right side, an arrow-head of flint fell out between the fourth and fifth bones. These skeletons lay about two and a half feet below the grass, and a pocket of oyster shells was over the head. The woman's remains lay within a space about 31 inches long by 50 inches wide, flat in the hard red sand bed facing east.

"Shortly after these remains were discovered, Mr. Chenoweth extended the excavation previously made by the explorers at the side of a large oyster shell pit in the same bank of sand, and uncovered a male skeleton of which he preserved the skull. Some small fragments of the skeleton were afterwards found by the writer on this spot. Contractors for the sewer in Seaman Avenue also uncovered the remains of a young female close to the position of several of the shell pits previously described.

"These interments have some curious features. The position of the remains facing east, sometimes west, the absence of weapons or other objects and the oyster shells packed with or above them are subjects for interesting discussion on which future finds may throw much light, as also upon the peculiar double burial and the burnt state of the female remains."

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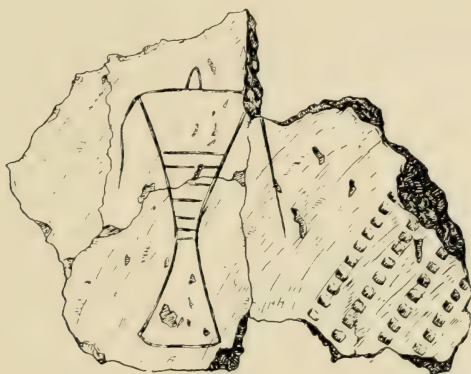
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THE THUNDERBIRD

Engraved on a fragment of pottery found at Shinnecock Hills, Long Island. The thunderbirds were gods and patrons of warriors and it is one of their duties to guard mankind from the evil horned serpents (page 10) that dwell under the earth or beneath the waters.

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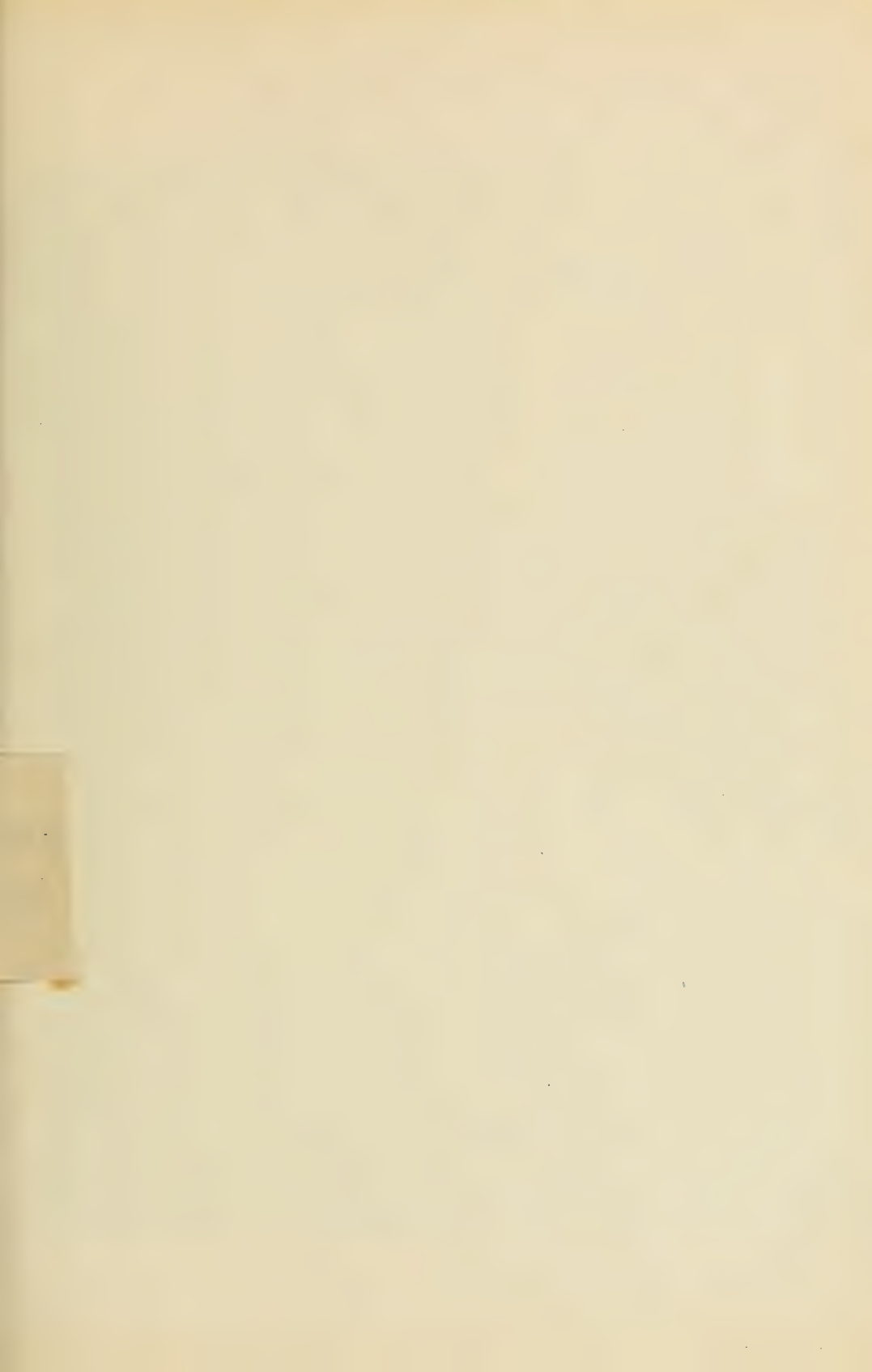
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A Big Tree may live 5000 years however, and perhaps longer if not destroyed by accident or disastrous climatic change. Those Big Trees of California averaging from 2000 to 3000 years old have lived no more than half, possibly only a fraction, of the time they might live. If they now escape fire and the ax, they are likely to continue to look down on the world for

still other thousands of years, while some hundred more generations of men are born and die, while present weakened civilizations decline and others better founded triumph.

Moreover, as the centuries go on, these trees will seem increasingly remarkable, for not only are they god-like among trees in stature and length of life, but also they are as strangely out of place among the world's other trees as would be the mastodon and mammoth among our deer and oxen. They belong to an old race which flourished, especially in the Arctic regions, during Tertiary and Cretaceous times and was destroyed by the coming of the Glacial Period. But the destruction was not quite complete: two species, the Big Tree and the redwood, on the oldest, warmest parts of California's mountains succeeded in bridging the time of ice. There today—and nowhere else on the globe—the remnant of the ancient race stands. The peculiar distribution in groves separated by wide gaps was probably caused by ancient glaciers which lingered in these gaps.

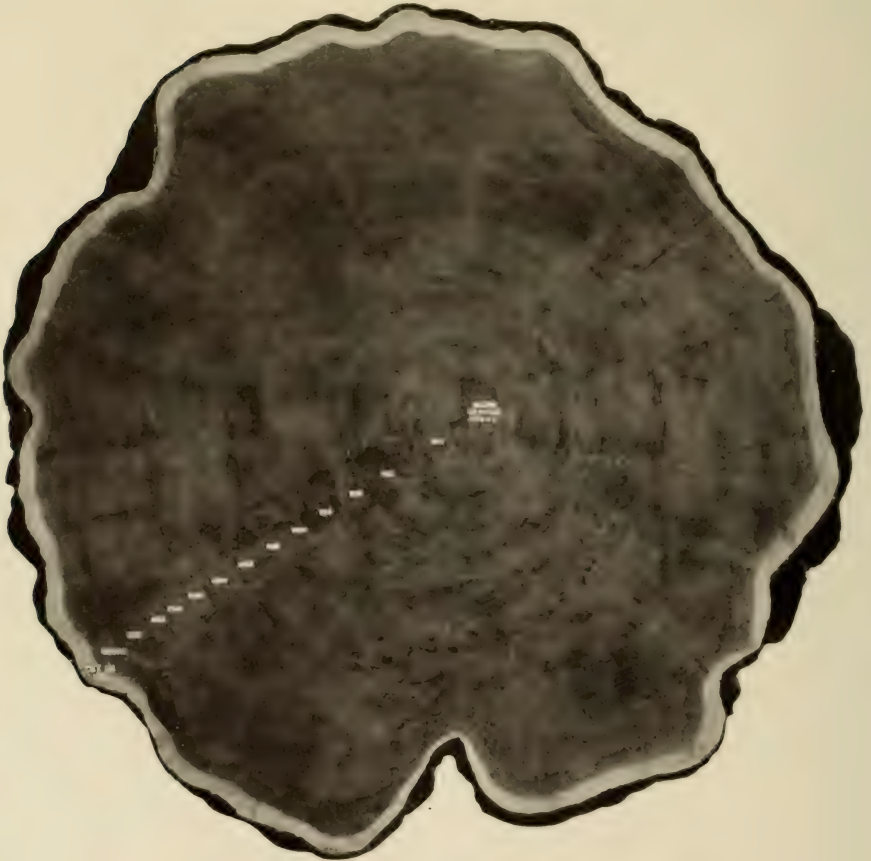
The section of the Big Tree "Mark

*The greater part of this leaflet was written by George H. Sherwood and appeared in Leaflet No. 8, The Sequoia. Additions and changes have been made by Henry E. Crampton and F. A. Lucas. The label is by Miss M. C. Dickerson.

Twain," shown below, was given to the Museum by Collis P. Huntington in 1891. It came from the Kings River Grove in Fresno County. The section measures $16\frac{1}{2}$ feet in diameter inside the bark and was cut from the tree twelve feet above

the ground. It was divided into twelve sections for shipping and after years of seasoning weighs nine tons.

The section immediately above this was presented to the British Museum by Mr. Huntington.



SECTION OF THE BIG TREE IN THE HALL OF FORESTRY



DISTRIBUTION OF THE BIG TREE

The relative sizes of the groves are indicated by the number of trees on the map.
The shaded portion of the small map shows how limited is the area covered by these trees.

THE SEQUOIA

IT is fitting that the entrance to the Hall of North American Forestry should be flanked on either hand by the Redwood and Sequoia. Not only are these the noblest of trees, but they are strictly North American trees and their name perpetuates that of the old Cherokee Chieftain Seequoyah.

It is with the Sequoia, however, that we are concerned, the greatest and probably oldest of living trees, although its claims to antiquity are now and then disputed by some claimant like the Bo-tree or sacred fig of Ceylon, a scion of the tree under which Gautama Buddha sat when he attained Nirvana, which has a recorded history of a little over 2200 years.

Another "oldest inhabitant" is, or was, the great dragon tree of Teneriffe, which, when blown down in 1868 was "estimated" to be 6000 years old. Estimates, like artists, are however unreliable and this age is given for what it is worth.

Still another ancient of days, or years, is the cypress of Santa Maria, Tule, Mexico, which, according to Frederick Starr has a circumference of one hundred and sixty feet, four feet above the ground. It is however very irregular in outline and is possibly formed by the union of three trunks.

The Sequoia is not only the oldest of trees, but the mightiest and while from time to time there have been reports of rivals in Australia, yet these rivals when brought to the ultimate test, that of the tape line, have shrunk before it, leaving the Sequoia the monarch of them all.

The Kauri Pine of New Zealand, so far as size goes is a really dangerous rival, and two examples are on record having respectively diameters of twenty-four and twenty-two feet, and estimated ages of 1396 and 1280 years.

The following are the measurements of a few of the largest trees in the principal groves; though of little value for comparative purposes, they serve to give an idea of the vast proportions of the Big Trees:

- A. Tuolumne Grove, diameter at 3 feet above ground, 23 feet.
- B. Fresno Grove, circumference at 3 feet above ground, 81 feet.
- C. King's River Grove, circumference near the ground 116 feet, height 276 feet.
- D. " " " diameter (without bark) at 120 feet above ground, 13 feet 2 inches.
- E. Calaveras Grove, (dead, without bark) diameter at 6 feet above ground, 25 feet, height 302 feet; circumference at ground, 96 feet.
- F. " " (dead, without bark) circumference at base 84 feet, height 321 feet.

- G. Calaveras Grove, (dead, without bark) diameter at 3 feet above ground, 23 feet 2 inches; height to present top 365 feet (estimated former height 400 feet).
- H. " " diameter at 6 feet above ground 14.3, height 325 feet.
- I. " " diameter at 6 feet above ground 12.7, height 319 feet.
- J. " " diameter at 6 feet above ground 19.4, height 315 feet.
- K. " " diameter at 6 feet above ground 15., height 307.
- L. Stanislaus Grove, circumference at base 103 feet, height 311 feet.
- M. Mariposa Grove, circumference at base 93.7 feet, circumference at 11 feet, 64.3 feet.
- N. " " diameter at 6 feet, 21.4 feet, height 270 feet.

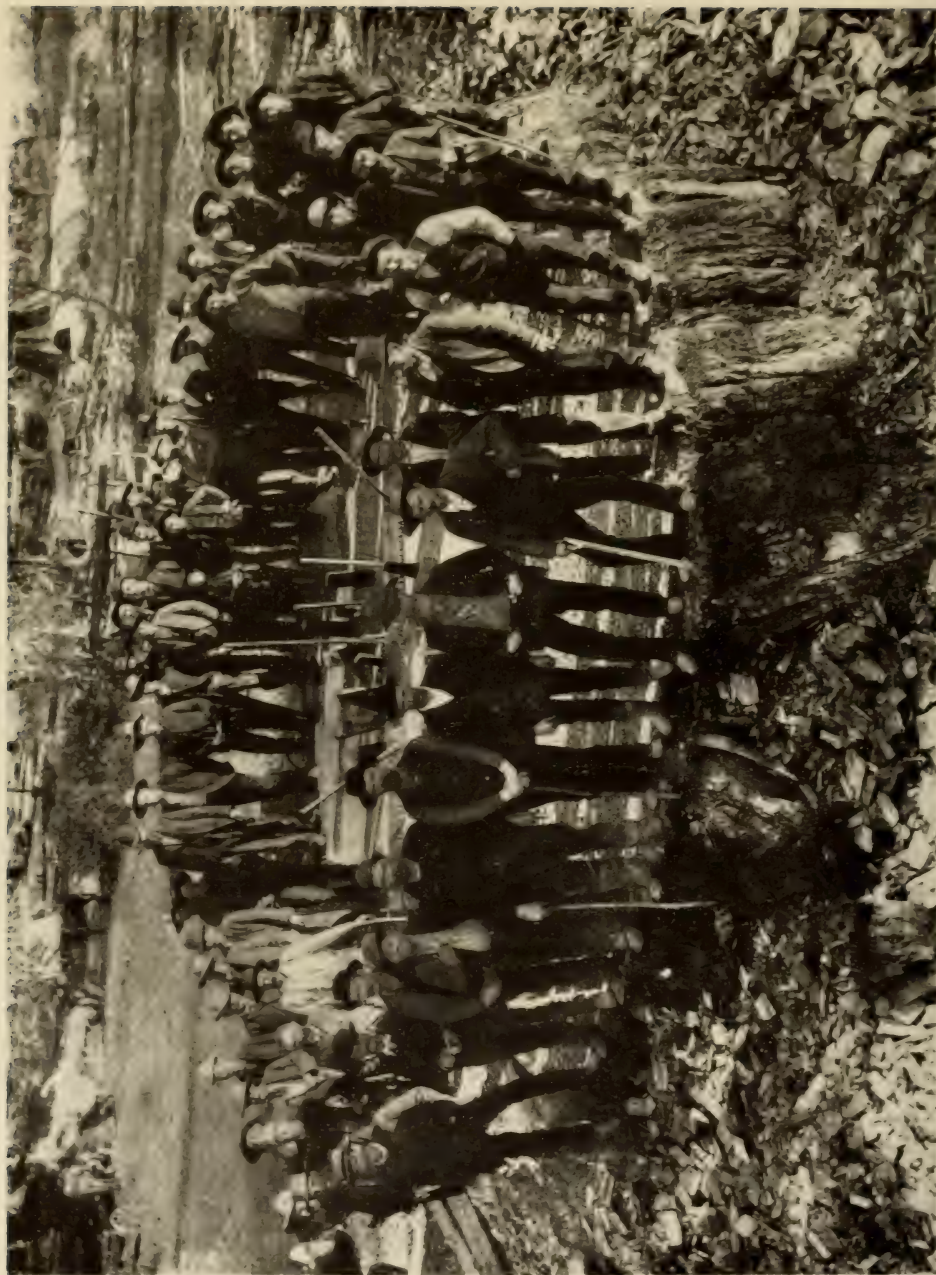
been removed. For this reason there are practically no seedlings in the shadows of the untouched northern groves, but wherever in the southern groves lumbering and fire have opened up the forest and exposed the mineral earth, an abundance of young Big Trees is always found near seed trees, unless, of course, fire has destroyed them. The dependence of this tree for its reproduction on direct sunlight and open soil is particularly evident in the Tule River cañons where very open stands of large Big Trees have invariably seeded up the washed gravelly soil.

It is evident that under favorable soil and light conditions the Big Tree is not lacking in reproductive energy, and that under these conditions it is holding its own in competition with other trees. Although it is but meagrely represented in the few scattered groups now preserved, the species seems still to possess that strong inherent reproductive power that permits survival of the fit.

And yet, seen by itself, the Sequoia is not a particularly fine or beautiful tree; it is too largely trunk. To appreciate its true grandeur it must be seen in company with its fellows, when the eye travels from one massive trunk to another, each towering upwards to be lost in a mist of foliage.

Once spread over a large part of the Ancient World the Sequoia is now making its last stand on the Sierras of our western coast, where it is confined to a few isolated groves found at altitudes of from 4000 to 8000 feet above the sea. Thirty-one of these groves or groups are now known, numbering from half a dozen to several thousand trees each, occupying altogether an

Curiously enough the decline of the big tree, like that of big states, is possibly due to the fact that it cannot stand prosperity. Shade and rich soil, factors conducive to the reproduction of most trees, are detrimental to the Sequoia; it demands sunlight and sandy soil from which leaf mold has



THE STUMP OF "MARK TWAIN"
Ninety feet in circumference

area of only about fifty square miles. This area is bounded on the north by the American River, and on the south by Deer Creek, and the total distance from the most northerly group (North Grove) to the most southerly (Tule River Grove) is only 260 miles. The King's River and Kaweah River Grove is the largest both as to area and number of trees. The extent of this district is four or five miles in width, and eight or ten miles in length. It has a variation in altitude of 2500 feet. It is an interesting fact that as one proceeds from north to south the Big Trees flourish at higher and higher altitudes.

As might be inferred from its age the Sequoia is tolerant of injuries and its recuperative powers great, so that it recovers from damage done by fires, ancient and modern, that have destroyed many other trees. Our own specimen has suffered somewhat, but Prof. Dudley has recorded one whose troubles date back to 245 A. D., at the age of 516 when a forest fire inflicted a wound, it took 105 years to cover. The next 1200 years were years of peace, but in 1441 A. D., at 1712 years of age, the tree was burned a second time in two long grooves one and two feet wide, respectively. Each had its own system of repair. 139 years of growth followed, including the time occupied by covering the wounds. 1580 A. D., at 1851 years of age, occurred another fire, causing a burn on the trunk two feet wide, which took 56 years to cover with new tissue. 217 years of growth followed the burn. 1797 A. D., when the tree was 2,068 years old, a tremendous fire attacked it, burning the great scar eighteen feet wide. 103 years, between 1797 and

1900, had enabled the tree to reduce the exposed area of the burn to about fourteen feet in width. It is to be noted that in each of the three older burns there was a thin cavity occupied by the charcoal of the burned surface, but the wounds were finally fully covered and the new tissue above was full, even, continuous and showed no sign of distortion or of the old wound.

The wood yielded by the Big Trees while vast in quantity is rather indifferent as to quality, being light, soft and brittle, though it does possess one good quality, that of durability in contact with the soil.

The methods of lumbering the Big Trees are wasteful in the extreme, more or less, of necessity. These huge trees are usually shattered in falling, but when they are not, logs of ten or twenty feet in diameter are a little too large to handle, so the fallen Sequoia is by the use of dynamite reft into pieces large enough to handle, a process that wastes about half the timber in a tree. Still, as Mr. Huntington writes, "3000 fence posts, sufficient to support a wire fence around 8000 or 9000 acres, have been made from one of these giants, and that was only the first step towards using its carcass. 650,000 shingles, enough to cover the roofs of 70 or 80 houses, formed the second item of its product; finally there still remained hundreds of cords of firewood which no one could use because of the prohibitive cost of hauling the wood out of the mountains."

Thus far the Sequoia in general—our own particular tree which came from the Kings River Grove, was felled in 1891 and literally cut off in the 1341st year of its growth. This to be sure is a good old age, as things



TREE SHATTERED IN FALLING

go nowadays, but Dudley speaks of a tree "of moderate age" that when cut in 1900 had reached an age of 2171 years, and Huntington "counted the rings of 79 that were over 2,000 years of age, of 3 that were over 3,000 and of one that was 3,150," a sturdy sapling at the time of the Exodus.

Compared with this, our own tree was in the full vigor of middle life, though it had lived through many of the most eventful periods in the history of the world: the most eventful so far as we are concerned. It witnessed the death of old nations, the birth of new and might well be considered as ancient when Columbus discovered America and the history of the New World really began. And what progress has this, our Sequoia, seen during its long career! When it began, steel, steam, electricity and all that they make possible, were unknown factors in the progress of civilization. And as for that combination of belief, theory and knowledge of living things that we term biological science, our Sequoia saw all save its birth with the writings of Aristotle. And as this science lay dormant for many years it really saw all worth seeing.

To Prof. Ellsworth Huntington belongs the credit of having found a scientific use for the large stumps of the Sequoia. As is well known, in regions where there is a marked difference between the climate of summer and winter, whether there be heat and cold or moisture and dryness, the years of a tree's life are marked by rings of annual growth.

Moreover the width of these rings shows whether the year was favorable or unfavorable for growth, a

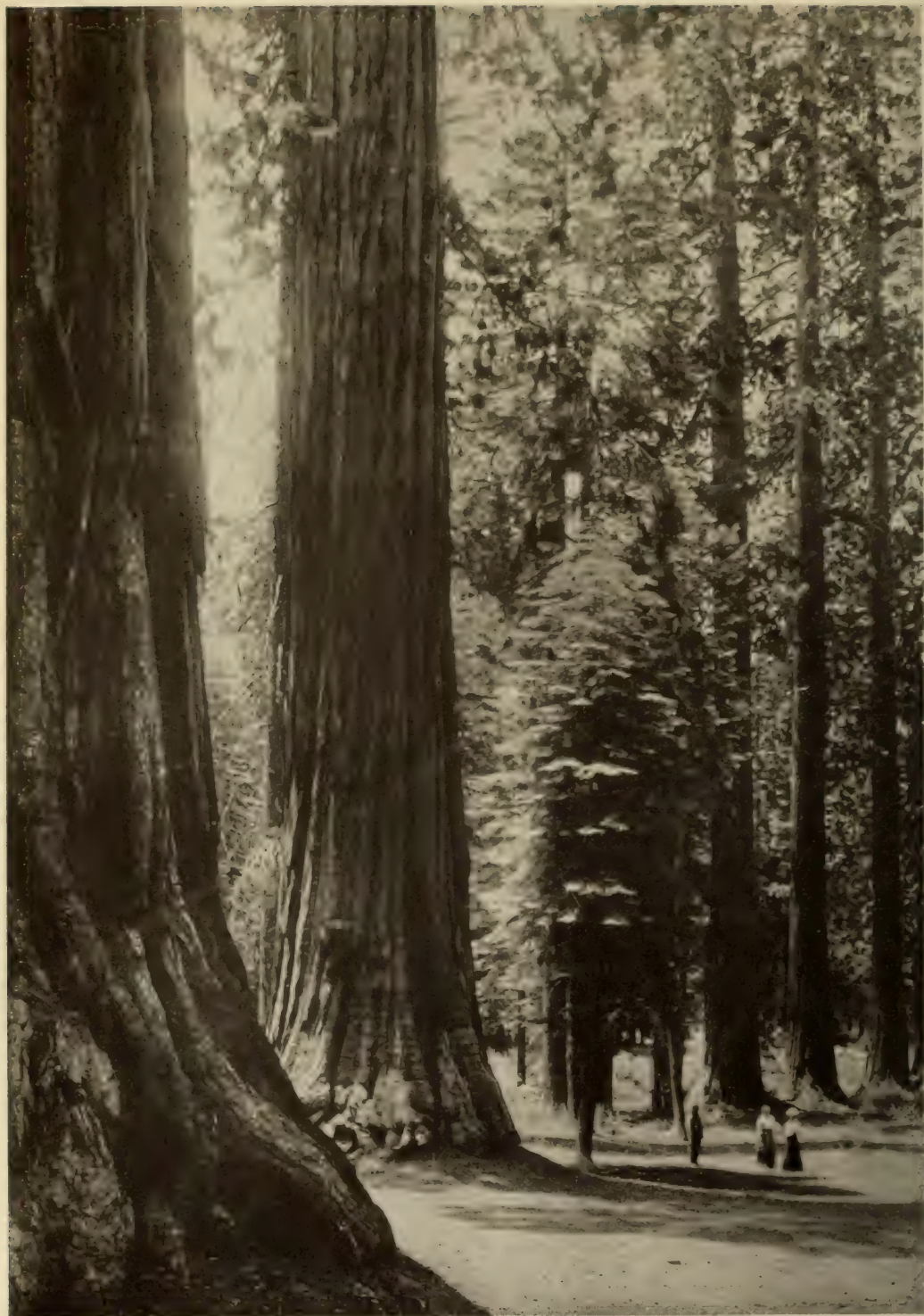
thick ring, for example, indicating a moist season, a thin one a dry year.

Owing to the great age attained by these trees they must have passed through many vicissitudes of climate, and if there have been appreciable changes of climate during a period of a thousand years, they should be recorded in the Sequoia by a succession of wide or narrow rings. So reasoned Prof. Huntington.

And this reasoning is borne out by the facts; knowing certain changes that have taken place in the last thousand years or so, indicated by abandoned cities, shrunk lakes and the transformation of fertile plains into deserts, he was able to show what changes had taken place during historic times and fix the dates of long periods of drouth. Now by counting the rings of the Big Trees and noting the favorable or unfavorable conditions recorded by them, Prof. Huntington was able to show that the records of the Sequoia corresponded with the known facts of history.

This method of research has been carried into geologic times, and by observation of the rings on the trunks of fossil trees, it has been possible to obtain an idea of changes of climate that occurred long ages ago.

When the tree was a mere sapling, Europe was overrun by the Goths, Vandals and Franks, and a state of almost universal war prevailed. About twenty years later Mahomet was born and then followed the establishment of the Mohammedan religion, which, during the next one hundred and fifty years, reached the zenith of its power and threatened to overrun the whole world. This Saracenic invasion was checked at the battle of Tours (732),



VIEW IN MARIPOSA GROVE
"General Grant," "General Sherman" and "The Four Guards."



VIEW IN CALAVERAS GROVE

"Mother of the Forest," in background, 84 feet in circumference.



FELLING THE TREE

in which the Franks under Charles Martel overwhelmingly defeated the Mohammedans. The beginning of the next century was marked with the crowning of Charlemagne on Christmas day, 800. This monarch made a noble effort to educate his people by establishing a school at his court and inviting thither the few learned men of his time.

The climatic conditions in California during A. D. 800 and the year preceding must have been very favorable for the growth of our tree, which had already attained the size of a large elm. Its growth during these two years, indicated by the large rings, was phenomenal.

During this century occurred also the effort of King Alfred to establish schools in England. The hardy Norsemen began their bold voyages in quest of treasure and adventure, colonized Iceland in 874, discovered Greenland (981), and pushing farther westward probably sailed down along the eastern shore of America.

The Crusades, begun in 1096 and continuing for almost 200 years, brought the various European peoples into intercourse, which resulted in exchange of ideas and helped prepare the popular mind for the discoveries which were soon to follow.

The first half of the thirteenth century saw the founding of the universities. First, the University of Paris (1200), which became the center of theology; a few years later were founded the University of Bologna, famous for law, and the University of Padua, which attracted the greatest students in medicine. In England, Oxford University was founded in 1249.

The fifteenth century brought those marvelous discoveries which were of so much importance in the advancement of civilization, and which contributed to the growth of science. Printing with wooden block type was introduced by John Gutenberg in 1438, and his invention was followed in 1450 with the use of metal type, making the general dissemination of knowledge possible.

Columbus' discovery of America (1492) was followed by Magellan's famous trip around the world to the westward (1519-1522), during which he discovered the Philippines; and about the same time Cortez conquered Mexico. The New World was soon explored for its reputed hidden treasures, and astronomers' search of the heavens for an orderly movement of planetary bodies resulted in the elaboration of the system of Copernicus (1543). Keppler announced his laws of planetary motion at about the same time (1609), and in the latter part of the seventeenth century Newton enunciated the law of gravitation. The increasing freedom of thought was expressed in the American and French Revolutions.

The rapid course of invention during the nineteenth century is too familiar to require detailed mention. The period of the tree's growth, however, is represented by only a few inches in its total diameter.

Not only the scientific side of all branches of biology, but also the philosophical or speculative side, has been developed during the old age of the tree, or during the last 300 years. In fact, modern zoölogy and inductive methods may be said to have begun

with William Harvey in the seventeenth century.

It is true that when the tree began its life, men had ideas and conceptions of the principles underlying nature, but most of these were crude and inaccurate, based on mere hearsay or tradition, and differing but little from those held before the beginning of the Christian era.

The science of anatomy had been at a standstill since the time of Galen (A. D. 130). This brilliant anatomist, it is true, advanced the study of anatomy by his careful dissections of apes and some of the lower animals, and he also wrote extensively on physiology; but accurate as some of his observations were, his errors, particularly in physiology, were many. His works, however, remained authoritative for fully 1400 years; his statements overruled the demonstrations of nature, and he was so revered that whoever had the courage to dispute him was liable to persecution and ostracism.

Physiology was not materially different from metaphysics, and both were affected with superstition. The ancient belief that the body contained *four humors*—"blood," "phlegm," "yellow bile," "black bile"—was held, and Galen had added to these a "pneuma," which pervaded the whole body, mingling with the humors and supporting life. The proper mixture of four elements—heat, cold, wetness and dryness—constituted the normal individual. The administration of drugs was in accordance with this belief. Systematic zoölogy did not exist. There was no true conception of species, no accurate description of animals, and no adequate system of

classification. The naturalists were merely compilers and copyists of Aristotle and other ancient writers, a most curious feature of their point of view, even as late as the early part of the eighteenth century, being their readiness to rely on what was said or written and their slowness to observe for themselves. The modern attitude of scientific doubt seems not to have occurred to them and, like Sir Joseph Porter, they never thought of thinking for themselves at all.

The philosophical or speculative in biology was retained by the clergy, almost the only persons really interested in the conservation of documents, and as a class the only ones able to read and write.

Some of the Greeks had given explanations of the succession of organisms on the globe and Aristotle, born 384 B. C., believed that the first animals arose from the ocean, and that low forms of life were constantly springing into existence by spontaneous generation, a fallacy that was not completely eliminated from biology until the nineteenth century.

Aristotle also perceived the principle of adaptation in nature, and considered the universe as the result of Intelligent Design. Such ideas of the Greeks had a marked influence on Christian thought for many centuries. Augustine (fifth century) believed that a living substance had been made by the Creator, and that from this had developed all the diverse organisms of the present time. Two other famous churchmen advocated similar views, Erigena in the ninth century, and Thomas Aquinas in the thirteenth, each the foremost scholar of his day.

But naturally a wider and deeper knowledge of biological phenomena was necessary before philosophical biology could have a strong foundation. Hence the philosophy of zoölogy in its modern form, dates from the awakening of science in the seventeenth century.

From the time that the Big Tree was a mere seedling up to the time that it measured fully 13 feet in diameter, there was scarcely a single discovery in the field of natural science worthy of record. One event, however, which occurred when the tree measured only 12 inches in circumference is of some interest. Silk was one of the treasures obtained from the Far East. Its production was carried on solely by the Chinese, who jealously guarded the silkworms and their eggs. The story is that two monks travelling in China succeeded in smuggling some eggs out of the country by concealing them in a hollow cane, and brought them into Europe. In the warm climate of the south the eggs developed into strong healthy worms. From such a humble beginning arose the extensive silk industry of southern Europe.

The stagnation of the study of anatomy for more than a thousand years was due to an extravagant admiration of Galen, over-confidence in his writings, and the failure of men to make observations for themselves, or to believe what they saw with their own eyes. Vesalius (born in 1514) was the first anatomist to assert independence, and to him is due the credit of laying the foundations of modern anatomy. Vesalius dissected the human body and accurately described what he found. He established a school of anatomy at Padua, and among his students was Fabricius, the teacher of

Harvey, who startled the world in 1619 with his discovery of the circulation of the blood. This discovery, which revolutionized the study of physiology, and gave new impetus to the study of anatomy, met with bitter opposition from the followers of Galen, but Harvey defended his views with success.

The opposition to Harvey set men to thinking, and investigation began. All forms of life were studied with all available means. Harvey, from an investigation of the development of the chick, laid the foundations of the study of comparative embryology, one of the four great supports of the theory of evolution; and he also propounded the theory of *Epigenesis*, a theory vigorously debated by philosophers for many years. The compound microscope, already mentioned, was applied to the study of organisms by Leeuwenhoek and Malpighi. The former demonstrated capillary circulation (1690) and discovered red blood corpuscles, infusoria and spermatozoa (1677). These spermatozoa were regarded by some as parasites of animal bodies, by others as embryos which only needed nourishment to develop into an adult form. Malpighi applied the microscope to the study of the chick, and his observations led him to announce the theory of *Preformation*, which was opposed to the epigenesis of Harvey.

The preformationists contended that a given organism contained within its sperm or ovum all the descendants of that individual with all organs and parts fully formed. In other words, embryos were only miniature adults, and were contained one within another like a series of Chinese boxes, in successive grades of size. The doctrine

of epigenesis held that each sperm or ovum contained a relatively *homogeneous* living substance which became differentiated by gradual changes into a mature individual resembling the parent. Preformation was supported by Spallanzani, Bonnet, Haller and even Cuvier. Its absurdity was shown by the work of Wolfe (1759), who firmly established the doctrine of epigenesis as it is understood to-day.

The stimulus given to research by Harvey's discovery, the intercourse and exchange of views among men, and the voyages to all parts of the world resulted in an accumulation of a great mass of facts, which were of little value unless classified. Conrad Gesner (in 1551-1558) had given a complete bibliography of zoölogy, and was one of the most important of the earlier naturalists. About a hundred years later Ray, an English zoölogist (1670), made an attempt to establish a "system of classification," but he had not the true conception of species. It remained for Linnæus to complete a system which served its purpose so well that it has remained practically unchanged to the present time.

Linnæus (1707-1778) was far and away the leading naturalist of his day, and his system of classification in which plants and animals were placed in groups according to clearly designated characters, was a great advance over any scheme previously devised. His great service to science, however, was the perfecting of the binomial system of nomenclature, or method of definitely naming animals and plants. Up to his time animals were known by brief descriptions of their more evident characteristics written in Latin, as that was the universal

language in science, and men of science (the term scientist had not then been devised). This descriptive method did very well so long as the number of known animals was small, but as the tide of commerce of the eighteenth century brought to Europe thousands of species before unknown, it became cumbrous. To overcome the difficulty Linnæus devised the plan of giving to each animal two names; the first, a general or generic name which should indicate the particular group to which the animal belonged; the second, a special or specific name to apply to that kind of animal alone. To fix the name still more definitely the name of the first describer of the species is now attached to the scientific appellation.

The Sequoia, for example, is known as *Sequoia washingtoniana* (Winslow), though, unfortunately this particular species does not offer a good, clear illustration of the principles of binomial nomenclature.*

Buffon (1707-1788) was the first of the great founders of the modern doctrine of descent with evolution. He supposed, like Bonnet, that the main groups of animals had arisen in a linear series, and he believed that the direct action of the environment brought about structural modifications that were inherited.

Erasmus Darwin (1731-1802),

*The name *Sequoia gigantea* is sometimes applied erroneously to the Big Tree, the correct name being *Sequoia washingtoniana* (Winslow) Sudworth. The question is considered at some length by Sudworth in Check List of the Forest Trees of the United States, Washington, 1908, pages 28, 29.

Briefly stated *Sequoia gigantea* is a synonym of *Sequoia sempervirens*, the Redwood and if for no other reason the rule "once a synonym always a synonym" would prevent its being used for the Big Tree.

grandfather of Charles Darwin, was another of the early evolutionists. He pointed out, among other things, that the universal struggle for existence involved plants as well as animals. Unlike Buffon, he emphasized the indirect or responsive modifications produced by the environment, thus anticipating Lamarck, but like his predecessor, he assumed the inheritance of such changes.

It was Lamarck (1744-1829), the contemporary and fellow-countryman of Cuvier, who was the first to express the blood-relationship of organisms, as is done to-day, namely, by means of the *genealogical tree*. This eminent anatomist and investigator held views much in advance of his time. He rejected entirely the fixity of species, and believed that all animals now existing had been derived from a common stock by a process of gradual change. In one place he affirms that "Nature needs only matter, time and space to produce all changes." The two factors which he believed most important in producing these modifications were the reaction of the organisms to their environment and the inheritance of the modifications resulting from this reaction and of the effects of use and disuse of organs.

Lamarck's theory was partially smothered in the ridicule which Cuvier heaped upon it. Cuvier was a firm believer in the immutability of species and his great authority in the biological field made him a powerful dictator of public opinion.

Among the naturalists of the eighteenth century, Goethe and Cuvier are conspicuous. The former (1796), although a great poet, made valuable contributions to science. He intro-

duced the word "morphology" as a designation for the study of form or structure, and was the first to advance the *vertebral theory* of the skull, that is, that the skull represents modified vertebræ. He recognized the significance of vestigial organs, such as the gill slits in human embryos, hinder appendages in whales, etc., and predicted the discovery of the premaxilla in man—the supposed absence of which was considered to be a character which distinguished man from the apes.

It was, however, Georges Cuvier (born in 1769), the famous French naturalist, who was the recognized leader in zoölogical science for more than half a century. He stands as a striking example of a man who was remarkably correct in his observations of nature, but equally incorrect in his generalizations. His work on the Tertiary mammals of France marked the beginning of palæontology. He was the first to point out the resemblance between "*Anchitherium*" and the modern horse, a fact which is one of the strongest evidences of evolution. He was a preformationist and believed in *Catastrophism* (the theory that the earth as it is at present is the result of successive catastrophes), rather than *Uniförmitarianism* (the belief that the present condition of the earth has been brought about by a gradual, uniform change). The work of Cuvier in comparative anatomy is also important, and he is called the founder of this science. He recognized the principle of correlated growth, and in "*Le Règne Animal*" improved the classification of animals.

The last century of our tree's life

was remarkable for the discoveries in all branches of natural science. De Blainville (1839-1849) and Lyell (1797-1875) made valuable contributions to palæontology and geology. Lyell's "Principles of Geology" (1830-1833) dealt a death blow to catastrophism, and is a work equal in importance in its own field to the "Origin of Species" in biology.

Milne-Edwards (1800-1818) enunciated the principle of the physiological division of labor. Von Baer (1828) announced the law that bears his name, namely, "individual development is a recapitulation of race development." Schleiden and Schwann (1838-1839) described cells in plants and animals, and propounded the cell theory. Valentin (1839) named the "nucleus," and was the first to speak of the "cell theory." Purkinje and von Mohl (1840) named the living substance of the cell *protoplasm*, a term in universal use to-day. De Barry (1843) observed the union of sperm and ovum. Kölliker (1846) demonstrated that spermatozoa develop in the tissues of the testes. Owen (1846) pointed out the difference between *homologous organs*, for example, the arm of man, fore limb of horse, and wing of bird, organs which are formed on the same structural plan, and *analogous organs*, for example, wing of bird and wing of butterfly, organs differing entirely in structure, but performing the same function.

Remak (1850) described "three germinal layers," and Huxley (1859) homologized them in the lower animals.

Rapid strides were made also in systematic zoölogy and in zoö-geography. The relations of the lower animals were worked out by Leuckart,

Vaughn, Thompson, Dujardin, Agassiz and a host of others.

Expeditions were sent out to explore the earth and the sea. Famous among these are the voyage of the "Beagle," on which Darwin served and did some of his earliest biological work; and the voyage of the "Rattlesnake," on which Huxley was Assistant Surgeon.

In 1859 Darwin published his "Origin of Species," a book which is universally admitted to have had more influence on human thought than any other work of the century.

Darwin's theory of the "Origin of Species" may be stated briefly as follows: All species tend to vary. No two individuals of the offspring of a pair are exactly alike. On account of this variation in structure or function, certain individuals are better able to thrive than their fellows. These animals transmit these characters to their offspring, which in turn survive in the struggle with their fellows. Thus nature eliminates those variations which are disadvantageous to the organism, each individual being tested in its struggle to maintain its existence. The accumulation of these favorable variations through many generations is supposed to produce an organism quite different from the original stock, or, in other words, a new form.

Few works have been constructed with more care and skill. For more than twenty years Darwin collected facts from all available sources, and made innumerable observations himself. The evidence in support of his theory was drawn from many branches of natural science: comparative anatomy, embryology, palæontology and zoö-geography. So num-

erous were the facts that he presented, and so careful was the exposition of his theory, that in less than twenty years it became the working hypothesis of nearly every biologist.

Long before Darwin's time the resemblance between groups of animals had been recognized, indeed, even by Aristotle and others among the ancient Greeks, and many new facts made known by investigators from Vesalius onward emphasized the significance of these resemblances. In 1620 Bacon published "*Novum Organum*," in which he advocated the unity of nature. Descartes (born, 1596) attempted to explain the universe on natural laws. Leibnitz (born 1646) advanced a theory of the continuity of organisms. The term "*evolution*" was introduced by Bonnet as a name of the process by which organisms had become differentiated. He expressed this relationship by introducing the idea of a "scale of beings," which formed the links of a chain. This conception has persisted up to the present time, in the expression "the missing link."

In 1844 a book called "*Vestiges of Creation*" appeared and caused quite a sensation. That this was published anonymously by its author, Robert Chambers, is significant of the attitude of the public toward the idea of evolution.

Naturally the "*Origin*" met with a storm of opposition, but it was vigorously defended by many new-won adherents among whom was Huxley. He it was who perhaps more than any other scientist secured for the "*Origin of Species*" a fair and impartial consideration and thus aided the cause of truth.

Among the earlier champions of Darwin's theory, were Lyell, Tyndall, Hooker and Spencer.

The last decades of the great tree's life witnessed astonishing developments in all branches of zoölogy. The number of known species has increased enormously owing to the enthusiasm of collectors in all parts of the world, and especially through the work of expeditions sent out by governments and museums, one of the most noted of such expeditions being that of the English vessel, the "*Challenger*" (1872-1876), which brought back more than 8000 species new to science. Institutions established by civilized governments all over the world, like the United States Fish Commission, organized by Professor Spencer F. Baird, as well as the National Museum and Geological Survey, have made great contributions to pure and applied science. The famous seaside laboratory founded at Naples by Professor Anton Dohrn in 1870 is a prototype of those at Woods Hole, Plymouth and Roscoff, all of which have materially aided in the advance of biological investigation.

Palæontology too has had a rapid growth. Cope, Marsh and Osborn in this country discovered and described more than a thousand new species of vertebrates, many of which are on exhibition in the Hall of Fossil Vertebrates. In invertebrate palæontology James Hall was one of the leaders, and a large part of the material upon which he did his monumental work is displayed in the Geological Hall.

Zoö-geography, one of the foundations of evolutionary doctrine began with Wallace's publication in 1876 of the "*Distribution of Animals*," the

first complete treatise in this department, and the base for all further work.

A complete revolution in the theory and practice of medicine has been brought about through the application of biological knowledge. The studies of Louis Pasteur upon yeast and its life were the beginnings of bacteriology and protozoology, which deal with the minute organisms causing numerous diseases of man and of lower animals. What biologists have discovered about the causes of malaria, yellow fever, small pox, and a host of other maladies has done more to alleviate human suffering than all of the researches made prior to the time of Pasteur.

Since Darwin's time, the all-inclusive doctrine of evolution has become better understood and more clearly formulated, especially as regards the central process of heredity. For a long time after the "Origin of Species" appeared, the main question in dispute was concerned with the supposed inheritance of modifications acquired during the lifetime of an individual. Spencer was the chief representative of those who adopted the Lamarekian dictum that such was the procedure in the transformations of successive generations. Those who upheld Darwinism contended that only the congenital factors were effective, and that the transmission of individually acquired characters was unlikely on *a priori* grounds. The work of many investigators on the minute structure of the cell, and especially that of Weismann in the last decade of the tree's life, provided definite evidence that there was a concrete physical basis of heredity which followed such a course during the lifetime of an individual and in the production of offspring as to render the

Lamarekian interpretation untenable. In the nuclei of all cells including the germinal elements is the deeply-staining substance called *chromatin*, which is derived equally from the two parental germs, and which is transmitted during the course of development to the germ-cells from which the offspring of the next generation arise, in a continuous and uninterrupted course. The chromatin bears the hereditary qualities of the species, in a way that is unknown in all of its details, but the fact remains that it does. Even the varied qualities of sex can be assigned to a specific number of the chromatin bodies. The results of breeding experiments with plants and animals, like those obtained even in Darwin's time by the monk, Gregor Mendel in the obscurity of his Austrian monastery garden, are in entire accord with the fundamental tenets of Weismannism. In brief, such facts and many others lead inevitably to the conclusion that the essential things in inheritance and in evolution are the congenital qualities, and that the environment has only a limited value in a quantitative way.

The whole doctrine of evolution, and its principal statement relating to heredity, are extremely important for all those subjects which are founded upon the study of the nature and biological relations of organisms, including man. Every department of human thought and life, social, religious, intellectual and industrial, has been profoundly influenced and modified by the marvelous discoveries of science which have occurred even since this Sequoia attained gigantic proportions.

What progress, material as well as

mental, has our Sequoia witnessed not merely in its life time, but in a small fraction of its life time. And what may the seedlings expect to behold, provided their career is not cut short by fire or ax? Which of Wells' two solutions of the World Problem will prove to be correct? Will mankind pass through existing conditions and, purged as by fire, rise to heights now undreamed of, or in the conflicts of

jealous powers and principalities and the equally bitter conflicts of labor and capital under stress of economic conditions will existing civilization come crashing to an end and from the ruins of the present a future and better civilization evolve in the slow march of centuries to come? The Sequoia of the days to come will have lived through it all.*

*Written in February, 1914.



NEARING THE END

A Logging Camp in a California Forest.

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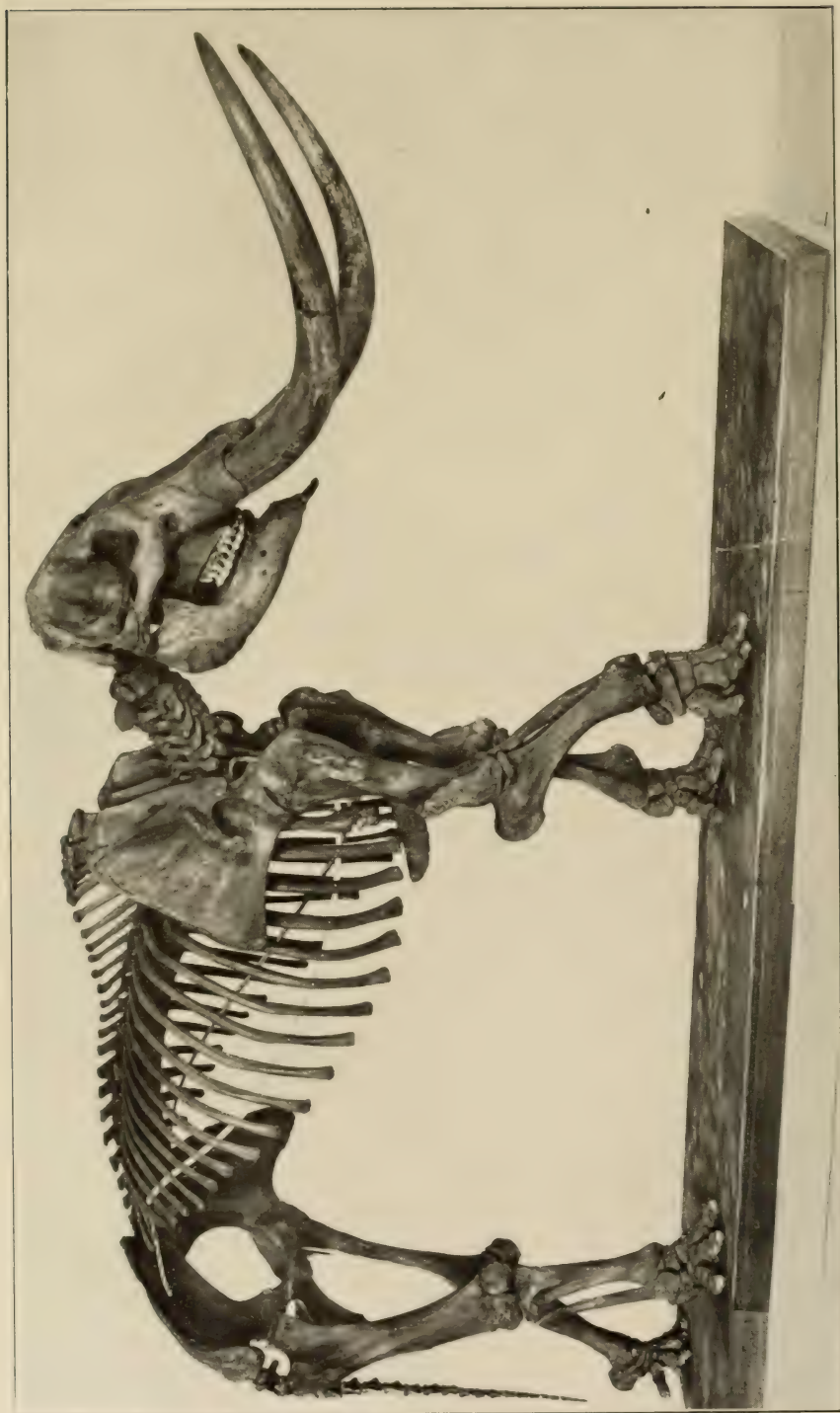
By

W. D. MATTHEW



THE AMERICAN MASTODON

Model by Charles R. Knight, based upon The Warren Mastodon skeleton
in the American Museum of Natural History



After Osborn

THE WARREN MASTODON SKELETON IN THE AMERICAN MUSEUM.

Mammoths and Mastodons

A guide to the collections of fossil proboscideans
in the American Museum of Natural History

By W. D. MATTHEW

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I. INTRODUCTORY.

ELEPHANTS now inhabit only the warmer regions of the Old World. The Indian Elephant is native to southeastern Asia, the African Elephant to central Africa. Both are forest and jungle dwellers, avoiding the plains and deserts and unknown in cold or temperate regions.

Mammoths and mastodons, extinct relatives or ancestors of the existing elephants have been found in nearly all parts of the habitable world, except in Australia. During the Pleistocene or Glacial epoch they ranged in the Old World from the Arctic Ocean to South Africa, from Japan in the east to England in the west, and in the New World from Alaska to Patagonia. They were of many different species; some nearly related to the living Indian or African elephant, others more distant cousins. In the Tertiary formations of the Age of Mammals, which preceded the great Ice Age, remains are found in the Old World and in North America of more ancient and primitive kinds, and their evolutionary history has been traced back step by step to an ancestry of primitive mammals of comparatively small size with no trunk and very unlike a modern elephant in both teeth and tusks.

Fossil teeth, tusks and bones of the skeleton are very commonly found in the surface soils, clays and gravels, and especially in peat-bogs or drained lands and in river valleys. On account of their size they have always attracted attention. In olden days they were often attributed to giants,* and it is not unlikely that many of the circumstantial stories and myths of mediæval giants were suggested by discoveries of this sort.

Early in the eighteenth century the discoveries of fossil teeth and bones recognized as belonging to elephants, in France, Italy, Germany and England were currently explained as relics of those brought by Pyrrhus or Hannibal or Julius Cæsar. About the end of the century, however, Cuvier demonstrated to the world not only that these relics were found in many regions never invaded by these warriors of antiquity, but that they belonged to distinct species from those now living. He was not indeed the first to make this discovery; various learned men of his time or earlier had come to the same conclusion, but its general acceptance was largely due to the great influence of Cuvier.

Besides the true elephants of extinct species Cuvier distinguished the mastodons (*μαστός*=nipple, *ὀδόνς*=tooth) with grinding teeth very different from those of elephants, although much like them in skull and skeleton.

In this country early discoveries of mastodon or elephant bones were also thought to be the remains of giants. Doctor Warren in his memoir

*This is not so absurd as it might seem, for most of the bones of an elephant skeleton are more like human bones, except as to size and massive proportions, than they are to most other large quadrupeds.

on the mastodon quotes an interesting correspondence between the learned Cotton Mather and Governor Dudley of New York, concerning the discovery of such bones on the banks of the Hudson near Newburgh. French explorers on the Ohio discovered great quantities of teeth and bones of mastodons and mammoths at the Great Salt Lick in Kentucky, and elsewhere along the river, and some of these were sent to France and studied by Cuvier and other scientists.

During the last century many fossil skeletons and skulls and innumerable teeth and bones have been found in all parts of the United States, in Alaska, Canada and Mexico and are preserved in various museums throughout the country.

Scientific notices of the fossil remains in America begin about 1750. They are mentioned by Thomas Jefferson in his Notes on Virginia, 1782, and noticed at more or less length by many other less distinguished authors, usually under the name of mammoth or elephant bones. Numerous descriptions and figures of the mastodon appear during the first half of the last century, culminating in the great memoir of John C. Warren 1852. Descriptions and notices of mammoths or other fossil elephants are hardly less numerous in American scientific literature of the last century, but no adequate treatise dealing with them has yet been published, nor is there any general treatise on the fossil proboscideans of the world. The literature is scattered and the subject much confused.

II. THE EXTINCT ELEPHANTS.

Genera, *Elephas*, *Loxodon*, *Stegodon*.

THERE are at least ten or twelve species of extinct elephants known in different parts of the world. Some are nearest to the modern Indian elephant (*Elephas*), others to the African species (*Loxodon*), while others (*Stegodon*) are intermediate between these and the older mastodons. Three species are found in North America, three or more in Europe and northern Asia, the remainder are chiefly known from India and the Mediterranean region. Probably there will be more when the world has been more thoroughly explored.

The Mammoth. The best known of all the extinct proboscideans is the mammoth, *Elephas primigenius*. It was a near relative of the Indian elephant, but adapted to live in cold climates, and covered with a heavy coat of long coarse black hair with thick brown underwool. The most abundant and perfect remains of this animal have been found in Siberia, and it is often called the Siberian mammoth, but it ranged through all the countries of the north—in Europe as far south as Spain and Italy, in North America as far south as North Carolina and California. It was able to endure the most severe cold, for its remains are found in greatest abundance

on the shores of the Arctic Ocean and buried in the frozen tundra of northern Siberia and the gold-bearing gravels of Alaska and northern Canada. Entire carcasses, with flesh and hide preserved more or less completely, have been discovered in Siberia. One such specimen, found by the explorer Adams in 1799 on the banks of the Lena, and another discovered on the Beresofka in 1901, are mounted in the Petrograd museum. Similar remains, only less complete, were found by Quackenbush on Kotzebue Sound, Alaska, and are in this museum. The contents of the stomach show that these animals fed upon the same vegetation, grasses and sedges, birches, alders, poplars, etc., that prevails today in the far north. The deeply frozen soils and gravels in which their remains occur were accumulated by the overflow



After Osborn

Fig. 1. Restoration of the Mammoth, *Elephas primigenius*, by Charles R. Knight.

and freezing of river sediments during a long and bitter winter, which the short summer season was not sufficient to melt except on the surface. There is no doubt therefore that the mammoths of Siberia and Alaska lived in an arctic climate. The range of the species southward as far as southern Europe and the United States is directly associated with the advance of the great ice sheets which extended southward from Labrador, Keewatin and the northern Cordilleras, as far as New York and the irregular line of

the great terminal moraine that crosses the northern states. In Europe similar ice sheets extended southward from Scandinavia across Great Britain and Germany and radiated outwards from the Alps, Carpathians and Pyrenees. The mammoths and other northern animals followed the ice sheets southward and ranged beyond their limits in the cooler temperatures that accompanied them.

With the mammoths came also the hardy hunters of the north—tall, active and intelligent races of men, whose pursuit was no doubt an important factor in their extinction. In compensation they have left us sketches and rude paintings of the great prehistoric beast, preserved on bone or ivory and on the walls of caverns in southern France and Spain. These sketches, crude and impressionistic as they are, have been of no small assistance in completing and rendering more lifelike the reconstructions of the mammoth made by Mr. Knight under Professor Osborn's direction.



After Lucas

Fig. 2. Drawing of the mammoth on ivory, by a prehistoric French artist.

A characteristic feature seen in all these drawings is the great boss of wool or hair on top of the head. This was not preserved in either of the two Siberian carcasses, and would not be suspected from the form of the skull. It gives the animal a noticeably different aspect from any previous restoration.

Alaskan mammoths. Gold mining in Alaska and the Klondyke has resulted in the discovery of numerous teeth and bones of the mammoth and a few skulls, but no complete skeleton has yet been recovered. In 1908 Mr. L. S. Quackenbush secured for the Museum considerable parts of a mammoth carcass from the margin of the frozen tundra at Elephant Point, Eschscholtz Bay. There had been much more of the specimen, but most of it had been destroyed and the remainder badly disorganized by erosion and sliding of the face of the bluff in which it was exposed. The tusks and lower jaws, pelvis and hind limb, several vertebrae and numerous fragmentary bones and pieces of skin, masses of hair and wool, flesh and fat were preserved. The principal parts are in the museum's

exhibit.¹ The remarkable freshness of these remains is due to their burial in soil permanently frozen ever since their entombment. They are probably many thousand years old. There is no reason to believe that the mammoth is still living in Alaska or has become extinct within the last few centuries. Various stories have appeared in the magazines and news-



After Osborn

Fig. 3. Molar teeth of extinct American elephants. Above, the mammoth, *E. primigenius*; middle, Columbian elephant, *E. columbi*; below, Imperial elephant, *E. imperator*. All $\times \frac{1}{4}$.

papers of the survival of the animal in the more remote parts of the territory, and its being seen or even captured by white men. All of them may be set down as purely mythical, and the alleged tradition among

¹Quackenbush, L. S., 1909, Bull. Amer. Mus. Nat. Hist., vol. xxvi, pp 87-130, pll. xvii-xxv.

the Eskimo of such an animal still existing is probably the result of inquiries by white explorers who provided the natives with the evidence as to appearance and habits of the animal. There is nothing impossible about these stories, but investigation has failed to show any valid evidence for them.

Skeleton of the Mammoth from Indiana. This fine skeleton was discovered on the farm of Dora S. Gift near Jonesboro, Ind., and purchased for the Museum in 1904. The feet and some of the limb bones were missing, otherwise it was fairly complete. The tusks were complete and in position when first found, crossing each other as in the mounted skeleton. This was demonstrated by sounding with an iron rod in the muck in which the skeleton lay buried. Unfortunately they were badly damaged by the finder in an unskillful attempt to get them out. After purchase by the Museum the tusks were repaired and the missing bones modelled in plaster mainly from casts of the fine skeleton of an allied species in the Paris museum, and the skeleton was mounted in 1906. The pose is based upon careful studies of the Indian elephant. The skeleton was at first thought to represent the Columbian elephant, but recent studies by Dr. O. P. Hay led him to conclude that it should be referred to the true mammoth. The restored limb and foot bones are probably somewhat too large and robust.¹

Size of the Mammoth. It would be natural to suppose that this animal was so called on account of its gigantic size. In fact, however, the derivation of the word is the other way about—the name of the extinct monster has passed into a synonym for hugeness and massive proportions. It is derived originally from the old Tartar designation, *mama 'ntu*, by which the remains found in Central Asia were called when first brought to the knowledge of western nations. The name is said to signify “earth-mouse” and to be connected with Chinese legends concerning the animal which lived underground and perished when it came to the light of day.

The northern mammoth was not in fact any larger than the modern Indian elephant, despite exaggerated notions as to its proportions. It was not as tall nor as bulky as the largest African elephants, nor was it as large as some of the other extinct species of more southerly range. The skeleton mounted in this museum probably represents the maximum size; the Siberian mammoths and those from Alaska are considerably smaller.

The Columbian Elephant, *Elephas columbi* Falconer, is a near relative of the mammoth and the Indian elephant, distinguished by the coarser plates of the teeth, and attaining a somewhat larger size. It inhabited most of the United States and Mexico, its range overlapping on the mammoth to the north and the Imperial elephant to the southwest. It is

¹Osborn, 1907, Bull. Am. Mus. Nat. Hist., vol xxvii, pp. 255-257.

Hay, 1912, Ann. Rep. Dept. Geol. Nat. Res. Indiana for 1911, pp. 719-722.

finely represented in the American Museum by the large male skull from Whitman Co., Washington, and female skull from Dallas, Texas.

The Imperial Elephant, *Elephas imperator* Leidy, is a still larger species, with decidedly coarser enamel plates in the grinding teeth, and gigantic



After Osborn

Fig. 4. Skull and jaws of Columbian elephant (male) from Whitman Co., Washington.
About one-tenth natural size.

tusks. It attained a size equal to the largest living African elephants, the height at the back between twelve and thirteen feet, the tusks ten inches in diameter and measuring 13 ft. 6 inches along the outer side of the curve

in a specimen from Victoria, Texas, in the American Museum. This elephant inhabited Mexico and the southwestern portion of the United States in the early Pleistocene, followed apparently by *E. columbi* during the later glacial stages. Jaws and teeth from various localities from Oregon to Guatemala are shown in the wall cases.

Extinct Old World Elephants. In the older Pleistocene of Europe, especially the Mediterranean coasts, two very large elephants are found—the Southern Elephant, *E. meridionalis*, corresponding to the Columbian elephant in this country, and also nearly related to the Indian, and the Ancient Elephant, *E. antiquus*, with affinities to the modern African species. These species ranged over large portions of Europe, southern Asia and Africa. In the islands of the Mediterranean have been found remains of pigmy elephants, dwarfed probably as a result of being isolated on the islands after they were separated from the mainland. Distinct pigmy forms have been described from Malta, Crete and Cyprus.

Pliocene and Pleistocene Elephants of India. *Evolution of Elephants from Mastodons.* Numerous skulls and teeth of fossil elephants have been found in the Siwalik and later formations of India. Besides the more typical species there are several which are intermediate in tooth structure between the elephant and the more ancient mastodons of the Tertiary formations, and are placed in the genus *Stegodon*—*S. latidens*, *S. clifti*, *S. insignis*, with tremendously long tusks little curved, and others. These intermediate stages, found only in southern Asia, indicate that it was in this region of the world that the elephants evolved out of the ancestral mastodon groups.

III. THE AMERICAN MASTODON.

Genus **Mastodon** (= *Mammot*)

NEXT to the mammoth this is the most familiar and best known of all the fossil proboscideans. Indeed, it is much more common in this country than the mammoth, and it has been stated that there are many more mastodon skeletons in museums of the United States and Canada than there are of modern elephants.

The mastodons of this genus were contemporaries of the mammoth, and like them ranged widely over the northerly parts of the world. They equalled or exceeded the largest mammoths in bulk, but were not so tall, the limbs being shorter while the body is broader and more massive.

Teeth of the Mastodon. The tusks are similar to those of the mammoth but the skull and jaws are of different proportions, not nearly so deep and short as those of elephants, and the teeth are of quite different type. They are much smaller and shorter crowned, and instead of the successive

plates of enamel alternating with dentine and cement, the grinding surface shows two, three or four cross crests with intervening valleys and no cement. These teeth are adapted for chopping the food, like those of the tapir. The elephants on the other hand grind the food as does the horse. The teeth of the mastodon are but little different from those of his Tertiary ancestors—Cuvier included them both under the same genus—but what difference there is is a perfecting of the chopping tapir-like type. As in the elephant they are gradually pushed forward in the jaw during wear, and break off at the front of the grinding row when worn down to the base. But there are usually two or three on each side of the jaw in use at one time instead of one or parts of two as in the elephants. A young adult will have three teeth on each side of each jaw—twelve grinders in all; in an old animal these are reduced to two, rarely to one in extreme age.

Habits and Environment. The wide differences in grinding teeth are doubtless correlated with differences in the food and range. The mastodons seem to have been especially abundant in the heavily forested regions



After Lucas

Fig. 5. Grinding teeth of mastodon and mammoth.

of the north. They are rare in the open tundra regions of Alaska and Siberia and in the plains and deserts of the western states and are most abundant in the heavily wooded sections of the eastern states, as far west as Michigan and Iowa and as far south as the Carolinas.

Their remains have been chiefly found in the course of drainage canals and ditches in the swamps and boggy lands in this part of the country, where no doubt they were mired and so preserved from decay. The boggy valleys southwest from Newburgh, N. Y., and swampy districts in central Indiana, Ohio, Illinois, Michigan and Iowa have yielded many skeletons, skulls and other parts. Nearly all these remains are of post-glacial age, showing that the animal was abundant in this country after the glaciers had retreated. It has not been found in any of the formations older than the Pleistocene. The contents of the stomach have been preserved in two or three skeletons and show that they fed on the twigs of hemlock, spruce and other evergreen trees, but probably they were not restricted to this diet. Remains of the hair of dark golden brown color, long, dense and shaggy, are recorded as preserved with a skeleton found in Ulster Co., N. Y.

The Warren Mastodon. This skeleton is the most perfect one ever discovered; it is a male of very large size. It was found at Newburgh in 1845, on the farm of Nathaniel Brewster, and purchased by Professor John C. Warren of the Harvard Medical School for his private museum. Doctor Warren published a memoir in 1852¹ describing it fully and discussing its habits and affinities, a classic treatise which is still the principal source of scientific knowledge of the American Mastodon. In it he also describes the Shawangunk Head—a finely preserved skull and



Fig. 6. Skull of the American Mastodon, one-eleventh natural size. This is the well known "Shawangunk skull" found at Scotchtown, Orange Co., N. Y., and figured by Warren in his memoir.

jaws of the largest size found at Scotchtown, Orange County, N. Y. Both these specimens along with the rest of the Warren Collection were purchased for the American Museum by Mr. J. P. Morgan in 1906. The skeleton has been remounted, the original tusks being repaired and set in position in place of the papier-mâché models used by Dr. Warren for his mount.

Male and Female Mastodon Skulls. Two skulls from Indiana illustrate the very marked differences between male and female of this species. The male has a much larger skull, the crests at the back higher.

¹Warren, 1852, *The Mastodon Giganteus of North America*, pp. i-viii, 1-219, and 28 plates.

the tusk sockets much heavier and longer. The tusks in the male are six to eight inches in diameter and six to eight feet or more in length. The tusks of the female are only three or four inches in diameter and four to six feet in length. The grinding teeth are much alike. There are no tusks in the lower jaw of the female mastodon, but in the adult male there is frequently a pair of small peg-like vestigial tusks, sometimes only one. These fall out in old individuals and the socket closes up; sometimes they are not present in young adult males. Various specimens in the wall case illustrate the presence or absence of lower tusks in the two sexes. Of the two skulls in separate case the larger is the *Ashley skull* found near Ashley, Indiana, in 1909; the smaller is the *Fulton skull* found near Fulton, Indiana, in 1915. A fine palate with tusks, two pair of lower jaws, separate tusks and parts of skeleton were found with the Fulton skull and are shown in the wall case. All belong to females of different ages, the complete skull being the oldest.

Distribution of the Mastodon. The American mastodon ranged all over the United States and Canada, and has been found in Alaska, Siberia and as far east as central Russia (Podolsk). In the wall case are shown specimens from Florida, Georgia and South Carolina illustrating its southern distribution, from Kansas, Texas and southern California, illustrating its western and southwestern occurrence, from Point Barrow, Alaska (collected by Vilhjalmur Stefansson), showing its northern range, casts of teeth from Russia to show its occurrence in the Old World. The closely allied species, *M. borsoni* is recorded from numerous localities in eastern Europe and Siberia.

IV. THE LATER TERTIARY MASTODONS.

Genera *Dibelodon*, *Rhyncotherium*, *Tetralophodon*, *Trilophodon*.

MIOCENE and Pliocene with some survivors in the Pleistocene (Glacial) epoch.

These proboscideans preceded the elephants and great mastodons of the age of man. They are of smaller size and include quite a variety of different types, some of which, in the Old World, are believed to be ancestral to the elephants (through *Stegodon*, see p. 24), while others probably gave rise to the American Mastodon. Most of the Tertiary mastodons, however, are more or less clearly off the direct line of descent, and their exact phylogeny is not yet certainly known. We will point out here only the general relations and distribution of the different types, so far as known.

The Two-tusked Mastodon.

Genus *Dibelodon* (= *Stegomastodon*). Pliocene of North America,

with a few survivors in the Pleistocene. Chiefly Pleistocene in South America, with a few precursors in late Pliocene.

Upper tusks large, up-curved or straight, with or without enamel band. Lower tusks vestigial or absent (usually absent). Cheek teeth short-crowned, the anterior molars falling out early in life, so that the young adult retains two and old individuals only one molar. The second molar has three cross crests, the last five to eight. The crests are not clearly defined as in the American Mastodon, but composed of a pair of conical cusps with a number of smaller cusps interposed, arranged in a trefoil pattern, so that the valleys between the crests are blocked in the middle instead of running clear across as in the later form. This is the primitive form among the mastodons, and appears in most of the Tertiary types with variations in the number and arrangement of the minor cusps, grouped customarily into the "single trefoil" and "double trefoil" type.

This genus therefore is a derivative of the primitive mastodon type (*Trilophodon*) of the Miocene, paralleling the elephant phylum in (1) loss of lower tusks and shortening of the jaw, (2) increase in size of the upper tusks with tendency to upward curvature and loss of enamel band, (3) reduction in the number of functional teeth, the last molar becoming the principal grinder.

The typical form is *D. mirificus* Leidy, the characteristic species of the Pliocene of North America, well represented by the fine skull and jaws and several other specimens from the Blanco formation of Texas, showing different stages of wear in the teeth. All the South American mastodons belong to this genus. They are chiefly from the Pleistocene formations ranging from Columbia to Argentina, but some may be as old as the late Pliocene.

The Long-jawed Mastodon *Tetralophodon*. This group of Tertiary mastodons is notable for the great elongation of the jaws in some species. The powerful upper and lower tusks are but little curved and directed forward. The enamel bands are preserved on both. The species are readily distinguished by the second molar which has four crests instead of three; otherwise the grinding teeth are much like those of *Dibelodon* but the anterior molars retained longer in use. It is characteristic of the Upper Miocene and early Pliocene of Europe, Asia and North America. The typical forms are *T. longirostris* and *arvernensis*, of Europe, and in this country *T. campester*, of which the type is shown in the wall case. In *T. arvernensis* the jaw is comparatively short with small lower tusks. Casts of jaws of the European species are exhibited in the wall case.

The Beaked Mastodon *Rhyncotherium*. In this genus the upper tusks are also stout, little curved and with enamel bands, but the

jaw is rather short, and the lower tusks and their sockets turned down at a sharp angle to the plane of the grinding teeth. It is a rare form, and the only representatives that we have found are from the Pliocene of Texas and Pleistocene of Mexico.

The Primitive Four-tusked Mastodons. Genus *Trilophodon* (= *Gomphotherium*). This group includes a large number of species from the Miocene of Europe, Asia, Africa and North America, representing the ancestral stock of the various later types of mastodons and probably of elephants. The typical form is *T. angustidens* Cuvier of Europe, a species with exceptionally long lower jaws and tusks. In this country it is admir-



After Osborn

Fig. 7. Skull of Primitive Mastodon, *Trilophodon productus* from Miocene of Texas. One-tenth natural size.

ably represented by *T. productus* Cope. The upper tusks are straight or slightly down-curved, the lower tusks well-developed, and both carry a strip of enamel. Two or three grinders are normally in use at once, and the second true molars have three cross crests. In one group (*Bunolophodon*) the cross crests are strongly trefoiled; in another (*Zygolophodon*) they are more ridged, the valleys less obstructed, approaching the American Mastodon in type. Different species in the first group approach more or less to *Dibelodon*, *Tetralophodon* and *Rhyncotherium* in the characters of the grinding teeth.

Although chiefly from the Miocene, there are several imperfectly known Pliocene or even Pleistocene species referred to it. These represent

survivals. The perfect skull and jaws of *T. productus* in the end case illustrates the primitive features of these Miocene mastodons.

The oldest mastodons from this country are from the Middle Miocene (*Merychippus* zone), and are too fragmentary to base any important conclusions upon their characters. They are shown in the wall case. *T. euhypodon* of the Upper Miocene and early Pliocene is well illustrated by the type specimen. *T. serridens* (very close to *T. turicensis* of Europe) of the Upper Miocene and *T. brevidens* of the Middle Miocene represent the *Zygolophodont* group, approaching the American Mastodon.

Dinotherium. This extinct proboscidean is found only in the Miocene and Pliocene of the Old World, and is very different from the contemporary mastodons. The cheek teeth have but two cross crests, except for the first molar which has three. The tooth row in the adult has five or six teeth, the premolars being retained while the true molars come into use. There are no upper tusks, and the *lower tusks* are large, stout, and *curve downward* to a right angle with the tooth-row. The skull has the general form of the later mastodons, and the animal undoubtedly had a long and heavy trunk. The body and limbs were proportioned much as in the American Mastodon. *Dinotherium* is chiefly found in the Miocene formations of Europe. A gigantic skeleton discovered in the Pliocene of Roumania exceeds the largest American mastodons in size. Smaller species are also found in Algeria and Tunis, in British East Africa, and in India. It is unknown in the New World.

Casts of palate, jaws, teeth and forefoot of different species of *Dinotherium*, chiefly from the Warren Collection, are shown in the Museum exhibit.

V. THE EARLY TERTIARY ANCESTORS OF THE MASTODONS.

Genera *Palæomastodon*, *Mœritherium*.

PALÆOMASTODON is chiefly known from the Lower Oligocene of the Fayûm district in Egypt but fragmentary remains have been recently found in the Gaj horizon of northern India, the lowest fossiliferous level of the great series of the Siwalik Hills. Its discovery and description are due to C. W. Andrews of the British Museum. It is unquestionably a primitive proboscidean, much smaller and more generalized than the earliest mastodons but showing clearly the especial characteristics of the order.

The upper tusks are small, down-curved, with enamel over the whole outer surface. The lower tusks are small, spatulate, and both upper and lower tusks have definite roots instead of growing from persistent pulps as do those of all later proboscideans.

There are five or six grinding teeth on each side of the jaw, twenty to twenty-four in all. The anterior premolars are simple crested teeth of a type very much like those of other primitive ungulates. The molars and last premolar have three cross crests; the third molar has also a crested heel.



After Osborn

Fig. 8. Skull of *Palæomastodon*, Lower Oligocene ancestor of the mastodons and elephants. One-tenth natural size. Fayûm district, Egypt.

The skull although primitive has the characters of proboscideans in the depression of the grinding series much below the level of the base of the cranium, the position of the openings for the nostril (anterior nares), set far backward and but little in front of the eye-orbits, the nasal bones much reduced and the entire construction of the face adapted for the accommodation of a trunk which, while evidently much less

developed than in the modern elephants or the mastodons, must have reached a considerable length. The cranium is built out above the brain-case with cellular bony tissue to a considerable extent, but much less than in the later proboscideans.

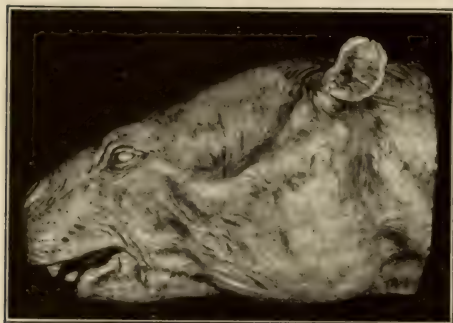


After Osborn

Fig. 9. Head of *Palæomastodon* modelled by E. Christman under direction of Professor Osborn. One-tenth natural size.

Skulls of *Palaeomastodon*, and also of the more problematic genus *Mærittherium* are shown in the end case. Below them are palatal views of the jaws and teeth of the same genera, and above are the carefully studied life-size reconstructions of the heads of the two genera, modelled directly upon the fossil skulls by Mr. Erwin Christman under direction of Professor Osborn.

Mærittherium is likewise from the Fayûm district, where it accompanies *Palaeomastodon* in the Lower Oligocene, but is also found in the older beds



After Osborn

Fig. 10. Head of *Mærittherium*, modelled by E. Christman under direction of Professor Osborn. One-tenth natural size.

of late Eocene age beneath this horizon. It has therefore been regarded as representing the later Eocene ancestor of the proboscideans. Its proboscidean characters, however, are by no means so clearly shown, and its ancestral position is open to serious question.

The skull is quite unlike any proboscidean type, having a long middle region and rather short face, with no suggestion of any trunk. There is a full set of upper incisors and two pair of lower incisors, but the second

upper and lower incisor are enlarged into stout short tusks, the upper projecting downward, the lower forward and upward. The cheek teeth are six in each jaw, the three premolars of a simple primitive-ungulate type, the true molars each with two pair of rounded cusps, imperfectly united into cross crests, the third lower molar with a distinct heel.

Dr. Andrews cites¹ the following characters in support of the proboscidean affinities of *Mærittherium*.

1. The large size of the nasal opening, its somewhat backward situation and the small size of the nasal bones.
2. The commencement of the development of air-cells in the bones of the back of the skull.
3. The enlargement of the second incisors in both jaws to form tusks.
4. The transversely ridged character of the molars.
5. The spout-like anterior portion of the lower jaw.

¹ Andrews, 1908, Guide to the Elephants Recent and Fossil. British Museum, London.

Against this view it has been pointed out² that none of these specializations are carried in *Mæritherium* to a degree that would serve to place it conclusively or definitely as proboscidean. All of them may readily be matched in various other living or extinct mammals which certainly have no proboscidean affinities. *Mæritherium*, although supposed to be the immediate ancestor of *Palæomastodon*, differs from it more widely than it does from the Miocene mastodons, separated by a much wider gap in time. And some of the differences appear to be not primitive characters but divergent specializations from the primitive ungulate type.

VI. THE EVOLUTION OF THE PROBOSCIDEA.

IN the preceding sections we have sketched briefly what is known about fossil elephants and mastodons, and their ancestors in the Tertiary period. The principal types are shown in the American Museum exhibit.

These fossil skulls and skeletons carry the ancestry of the proboscideans as far back in geological history as the Eocene. Although we do not regard *Mæritherium* as a direct ancestor of *Palæomastodon*, it represents in many respects the primitive type of ungulate from which the proboscideans were derived.

Mæritherium is an animal of quite moderate size; it has no indications of a trunk; the head is long and low, the brain-case small with little or nothing of the cellular bony cover that builds up the later proboscidean skull into so remarkable a bulk. The teeth have departed relatively little from the primitive type common to all early mammals, of three incisors, a canine, four premolars and three molars in each jaw—44 teeth altogether. A pair of upper and lower incisors have been enlarged, the third lower incisor lost, and each molar has two pairs of cusps on the crown, not yet fully united into cross crests. The posterior premolars have taken on in part the character of the molars. Little is known of the skeleton save that the limbs were of moderate length, the knee much more bent than in the later proboscideans.

Palæomastodon is clearly of proboscidean type, and there is a wide structural gap between it and *Mæritherium*. The enlarged pair of incisors are much elongated and the enamel confined to the outer face. The long forward reach and moderate downward curvature of the upper incisors, the great length of the front of the jaw and close set lower incisors, pro-

²Osborn, 1909, *Nature*, Vol. lxxxi, p. 139. The problem of the affinities of *Mæritherium* is here discussed at some length.

Professor Osborn concludes that: "It would not be far from the truth to say, from our present knowledge of the animal, that *Mæritherium* is an offshoot of the Proboscideo-Sirenian stock, with slightly nearer kinship to the elephants than to the Sirenians." See also Dr. Andrews' reply to the above (*ibid.*, p. 305), concluding as follows: "On the whole it seems that the weight of evidence is in favor of regarding *Mæritherium* as a proboscidean, though perhaps not on the direct line of ancestry of *Palæomastodon*, and retaining some characters of the original Proboscideo-Sirenian stock."



Fig. 11. Molar Teeth of Proboscidea. Above, elephants, living and extinct:—from left to right Imperial and Columbian elephants, Mammoth, Indian and African elephants. Below, mastodons and primitive types:—from left to right *Mastodermum*, *Palæomastodon*, *Dinotherium*, *Trilophodon*, *Mastodon*.

jecting forward and slightly downward are characteristically like the most primitive of the Miocene mastodons (compare *M. productus*). Three of the four premolars are still retained in the adult, but the construction of the molars, with their three cross crests, is unmistakably a near approach to the early mastodons. The skull is no less clearly that of a primitive proboscidean, in the depression of the palate and grinding teeth far below the level of the base of the cranium, the withdrawal of the anterior nares (opening for the nostril) to accommodate a flexible upper lip lengthened out undoubtedly into a trunk of considerable length, and various other particulars. It is obviously widely different from *Moritherium*. The skeleton is only partly known, but is more clearly of proboscidean type, with short rounded five-toed feet, rather long and nearly straight limbs, short neck and deep compact body. The heavy foot-pads seem to have been much less developed than in the elephant, the heel much more primitive and resting nearly on the ground.

Dinotherium of the European Miocene, a contemporary of the Mastodons is an aberrant side branch of obscure ancestry. It can hardly be a descendant of *Palaeomastodon*, since the molars (except m_1) are decidedly simpler having only two crests, and the premolars are likewise of simpler construction. The grinding teeth indeed are more readily derived from those of *Moritherium*. The skull, however, is highly specialized for a large and long trunk, no upper tusks are known, while the lower tusks are very large, long and stout, curving downwards to a right angle with the grinding teeth. The skeleton is thoroughly proboscidean in type, with long limbs and elephantine feet and the latest species *D. gigantissimum* reached a size fully equal to the largest of the elephants. Remains of *Dinotherium* have been found in the Miocene of India and Baluchistan and of central Africa, as well as in Europe and northern Africa, but its exact affinities and place of origin remain as yet unknown.

Trilophodon. The next stage in the ancestry of the mastodons and elephants is well shown in the fine *Trilophodon productus* skull. Although of a somewhat later age this species retains little changed the characters of the earliest known mastodons of the Lower Miocene of Europe, Asia and northern Africa. There is a very considerable gap between them and *Palaeomastodon*, representing the evolution of the race during the whole of the Oligocene epoch. They are very much larger animals. The tusks are greatly lengthened, and rootless, growing from persistent pulps. The enamel is reduced to a rather narrow strip. The posterior grinding teeth are progressively enlarged, the anterior ones lost, falling out early in life. The cranium is built up into a great bulk by the cellular bony covering over the brain-case.

Tetralophodon, Dibelodon, etc. The numerous remains of mastodons in the Miocene and Pliocene of Europe, Asia and North America show a progressive divergence into several distinct types. In one series the elongation of the jaw, already great in *Palaeomastodon*, is carried to an extreme, culminating in such types as *Tetralophodon campester* and *longirostris*. The intermediate molars have four crests, the last molar up to eight, but the cresting remains imperfect and the cross valleys are blocked. This is the *Tetralophodon* group of the late Miocene and early Pliocene of Europe, Asia and North America. In a second group, chiefly found in the New World, the upper tusks are enlarged and often curve upward; the band of enamel on their outer surface is sometimes retained but more often disappears completely. The lower tusks are lost, the jaw shortened, the posterior grinding teeth progressively enlarged, while the anterior ones are early lost. The teeth remain short-crowned although a small amount of cement is often present in the valleys. This is *Dibelodon*, common in the North American Pliocene and South American Pleistocene. All the Mastodons of South America belong in this group. In a third group *Rhynchotherium* the front of the lower jaw is bent downward at a sharp angle, the lower tusks large and straight. Little is known of this group, found only in Mexico and Texas.

Mastodon. A fourth group leads up into the great American Mastodon. In it the jaw is shortened, the lower tusks become vestigial, the cross crests of the molar teeth are perfected into a chopping tapir-like type. The upper tusks are large, curve upward with a spiral twist as in the elephants and have no enamel. Early stages are seen in *Trilophodon turicensis* of Europe, *T. brevidens* of Montana and *T. serridens* of Texas, of Miocene age; *M. borsoni* of the Pliocene and Pleistocene of Europe and *M. americanus* of the northern Pleistocene represent its culmination.

Stegodon, Elephas. The fifth and most important group leads up through the various species of *Stegodon* of the Pliocene of India into the elephants. In this group the jaw is greatly shortened, the lower tusks completely disappear and the upper tusks as in the American Mastodon are enlarged and curve upward. The posterior grinding teeth are progressively enlarged while the anterior ones are early lost. The crests of the molar crowns become progressively higher, narrower and more numerous, while the valleys are filled with cement, so that during wear the grinding surface presents cross ridges of enamel alternating with softer dentine and cement. The skull is greatly shortened, the trunk lengthened, the cranium built out with cellular bone, reaching finally the extreme specialization seen in the Pleistocene and modern elephants. The length of the limbs is also much increased, coördinately with the length of trunk.

The maximum of size is reached in the early Pleistocene elephants of Europe and North America—*E. antiquus*, *E. meridionalis*, *E. imperator*. But the mammoth shows the extreme of specialization in the grinding teeth, the enamel crests more numerous and closer set than any other species.

Origin and Dispersal of the Proboscidea. The fact that the oldest and most primitive remains of ancestral proboscideans have been found in Egypt has been commonly taken as proof that the original home of the order was in Africa. This may or may not be true. The absence of any ancestral proboscideans from the early Tertiary faunas of Europe and of the New World affords indeed reasonably conclusive evidence that they did not originate in those regions, and more indirect but fairly good evidence that they did not originate in the intervening regions of northern and central Asia from which a large part of their Tertiary faunas seems to have been derived. But of the early Tertiary faunas of southern Asia and of Africa we know nothing at all, save for the Fayûm faunas of northern Egypt, an area which is today transitional in its fauna between the two great regions, and decidedly more Asiatic than African in its affinities. While it is wholly probable that certain elements of the Fayûm fauna represent groups of early African origin, others are clearly of Asiatic affinities. It is not yet clear whether the Proboscidea are a group of Ethiopian or of Oriental origin. The choice is practically limited to these two regions.

The later evolution of the mastodons into the elephants appears to have taken place in the Oriental region, since intermediate stages are absent from the later Tertiary faunas of all the other regions, and a full series is found in India. But with the oncoming of the Glacial cold, the dispersal centre seems to have shifted to the north, for we find both in Europe and North America the highly specialized mammoth and mastodon spreading outwards from the north, and replacing other species more gigantic in size but less specialized in teeth. Today we find the African elephant, huge but somewhat primitive, surviving in a somewhat isolated tropical continent, and the Indian elephant, more progressive in its teeth but less so than the mammoth, surviving in tropical Asia, while the last step in specialization, the northern mammoth, after overrunning three continents in the later Pleistocene, has been completely swept away, following his predecessors in the northern countries to extinction. That the same fate awaits the African and Indian elephant, save as they may be preserved artificially in parks or by domestication, can hardly be doubted. Man has witnessed or aided in the extinction, during the short time that he has occupied the globe, of many magnificent types of the larger quadrupeds—but none so gigantic in size or so remarkable for peculiarities of structure and habits as are the great Proboscidea. That we have been able through the researches of science to preserve and reconstruct the

remains and restore the form and habitat not only of those extinct species known to our prehistoric ancestors, but of their ancestors and predecessors of older geologic epochs, and to trace the history and evolution of the race, may be some palliation for the widespread destruction and extinction of the greater quadrupeds that has accompanied the development of civilization.



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GENERAL GUIDE

TO THE

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New York, August, 1916

Published by the Museum

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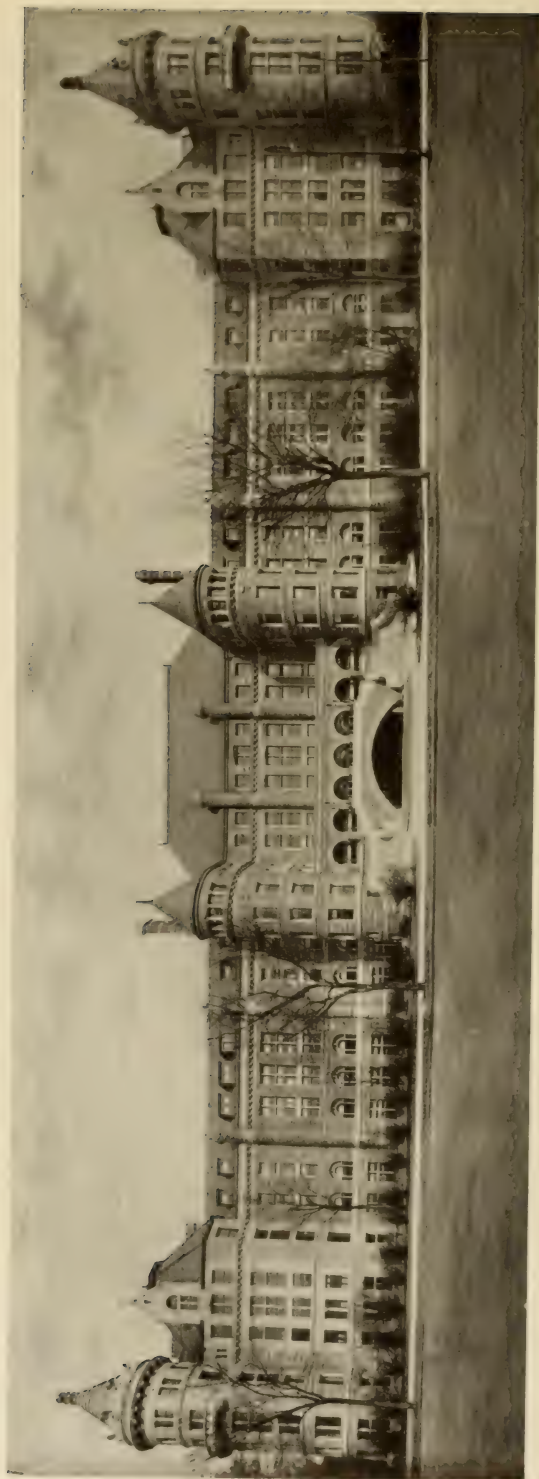
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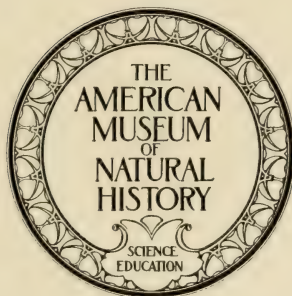
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GENERAL GUIDE
TO THE
EXHIBITION HALLS
OF THE
AMERICAN MUSEUM OF NATURAL HISTORY

BY
FREDERIC A. LUCAS, Director
Assisted by Members of the Museum Staff



GUIDE LEAFLET SERIES No. 44

New York
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August, 1916

The first General Guide to the Collections, comprising 54 pages and 16 illustrations, was issued in January, 1904.

The present edition comprises 136 pages and 75 illustrations.

A list of the popular publications of the Museum will be found at the end, beginning on page 134.

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The halls are named according to the position they will have in the completed Museum building, which will consist of four long façades facing east, west, north and south respectively, each connected with the center of the quadrangle formed by a wing extending between open courts. Thus the hall at the eastern end of the south façade (the only façade completed) becomes the "southeast pavilion."

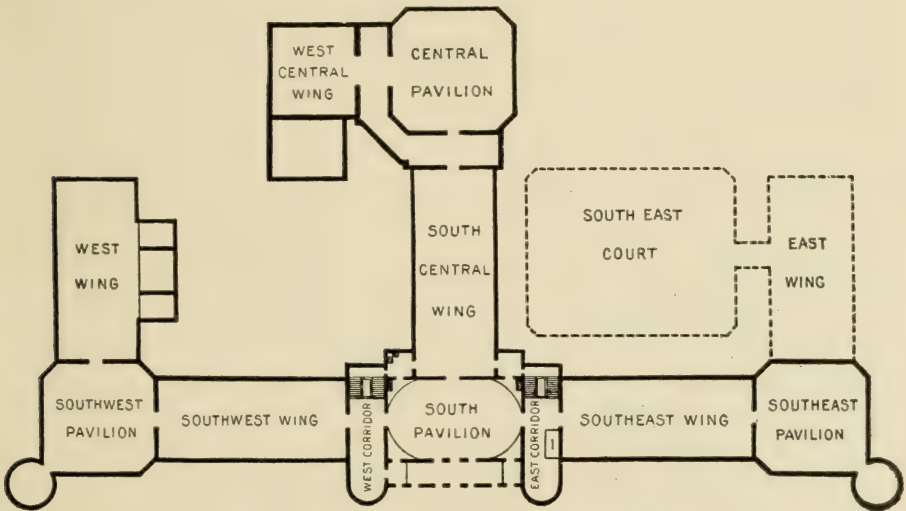
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Prefatory Note.

It is the purpose of this Guide to call attention to the more important exhibits that the visitor will see as he passes through the halls; more detailed information regarding many of them may be obtained from the labels or from the *Guide Leaflets*.

It is frequently necessary to rearrange the exhibits in order to provide space for new material or to put into effect advanced ideas regarding methods of exhibition, and as these changes are taking place all the time, it unavoidably happens that now and then discrepancies will be found between the actual arrangement of the specimens and that noted in the GUIDE. Dr. Goode has said that a finished museum is a dead museum, and it is hoped that the visitor will look upon these necessary changes as indications of life and progress.



The halls are named according to the position they will have in the completed Museum building, which will consist of four long façades, facing east, west, north and south respectively, each connected with the center of the quadrangle formed by a wing extending between open courts. Thus the hall at the eastern end of the south façade (the only façade completed) becomes the "southeast pavilion."

GENERAL GUIDE TO THE MUSEUM

INTRODUCTION

The History and Work of the Museum

THE American Museum of Natural History was founded and incorporated in 1869 for the purpose of establishing a Museum and Library of Natural History; of encouraging and developing the study of Natural Science; of advancing the general knowledge of kindred subjects and to that end, of furnishing popular instruction.

History For eight years its temporary home was in the Arsenal in Central Park. The corner stone of the present building in Manhattan Square was laid in 1874 by President U. S. Grant, and in 1877 the first section (South Central Pavilion) was completed.

Location The Museum is located at 77th Street and Central Park West, and can be reached by the 8th or 9th Avenue surface cars, the 6th or 9th Avenue elevated to 81st Street station, or by the subway to 72nd or 79th Street station. The Museum is open

Hours of Admission free every day in the year; on week days from 9 A. M. to 5 P. M., on Sundays from 1 to 5 P. M.

The Museum building is one of the largest municipal structures in the City, and has cost approximately \$5,000,000. The South Façade is 710 feet in length; the total area of the floor space is 470,789 square feet, or about 10 acres, of which 271,886 square feet are open to the public. The building when completed is designed to occupy all of Manhattan Square.

The building is erected and largely maintained by the City, through the Department of Parks. Building funds are provided for

Administration and Support by issues of Corporate Stock, which have been made at intervals since 1871. The annual appropriation, known as the Maintenance Fund, is devoted to the heating, lighting, repair and supervision of the building and care of the collections.

The Museum is under the control of a self-perpetuating Board of Trustees, which has the entire direction of all its activities as well as the guardianship of all the collections and exhibits. The Trustees give their services without remuneration.

The funds which enable the Trustees to purchase specimens, to carry on explorations and various forms of scientific work, to prepare and publish scientific papers and to enlarge the library are raised by contributions from the Trustees and other friends. These contributions come from three sources—namely, (1) the Endowment Fund, (2) Membership Fund, (3) voluntary subscriptions.

The interest of the Endowment Fund, which includes the magnificent bequest of Mrs. Jesup, may be used for additions to the collections, research, and for publication. It can not be used for the care or repair of the building, construction of cases or other maintenance work, that is properly the province of the City to provide for.

The Membership Fund, derived from the subscriptions of Members, may be devoted to any purpose and is of particular importance in the educational work of the Museum.

Voluntary contributions may be used for general purposes or for such special object as the donor may designate; some of the most valuable and important collections have been obtained by such gifts.

There are at present about 3,700 Members. Annual Members contribute \$10 a year for the support of the Museum; Life Members make a single contribution of \$100. Membership fees are of great service in promoting the growth of the institution.

In the last edition of the Century Dictionary a museum is defined as:

Definition of a Museum "A collection of natural objects, or of those made or used by man, placed where they may be seen, preserved and studied. Neither the objects themselves nor the place where they are shown constitutes a museum; this results from the combination of objects, place and purpose, display being an essential feature. The objects, or specimens, may be shown for general purposes only, or for the illustration of some subject or idea, the tendency of modern museums, being by the display of objects and the manner in which they are arranged and labeled to illustrate some fact in nature or in the history of mankind."

And E. Ray Lankester has very clearly stated that:

"The purposes of a great national museum of natural history are:

Purposes of Museums (1) To procure by its own explorers or by the voluntary assistance of independent naturalists the actual specimens upon which accurate knowledge of the animals, plants, and minerals of the earth's surface, and more especially of the national territory, is based; to preserve and arrange these collections for study by all expert naturalists, and to facilitate, directly or indirectly, the publication (in the form of catalogues or monographs) of the knowledge so obtained—with a view to its utilization, not only in the progress of science, but in the service of the State. (2) To exhibit in the best possible way for the edification of the public, at whose charges these collections are made and maintained, such specimens as are fitted for exposure in public galleries, with a view to the intelligent and willing participation of the people in the maintenance of the Museum."



Photo by
Underwood &
Underwood, N. Y.

BLIND CHILDREN STUDYING THE COLLECTIONS
At the North Pole with Peary.

The Museum not only maintains exhibits "for the edification of the public," but supplements the educational work performed by these and their accompanying labels by lectures and publications of a popular nature. A course of evening lectures is given every Spring and Fall for the Members, to which admission is to be had by ticket; also courses of Science Stories are given on Saturday mornings for the children of Members. Another series of lectures, free to the public, is given in conjunction with the Board of Education on Tuesday and Saturday evenings. Still another series, under the direction of the Museum's Department of Public Education, is given for the children in the Public Schools, and there are special lectures for the blind provided for by the Thorne Memorial Fund. The educational work of the Museum is carried still farther by means of its circulating collections for illustrating nature study which are sent free to the schools of Greater New York. The extent to which these collections are used is shown by the following statistics for the last five years:

	1911	1912	1913	1914	1915
Number of Collections in use	512	537	597	675	671
Number of Schools of Greater New York Supplied	486	491	501	470	473
Number of Pupils Studying the Collections	1,253,435	1,275,890	1,378,599	1,273,853	1,238,581

The scientific side of the work of the Museum is based upon its explorations and study collections.

The Study Collections, as the name implies, are not only for the benefit of students but preserve a record of our vanishing animal life and of the life and customs of our own and other primitive peoples.

In the case of Natural History the vast majority of the specimens are in the study series, not only because they would ultimately be ruined by exposure to light but because the display of all material would only confuse the visitor. Moreover, no museum has room to show everything, and a careful selection is made of objects of the greatest educational value and these are so displayed as to enhance their interest and attractiveness.

The Study Collections are, briefly, as follows:



HOW SPECIMENS ARE CARED FOR

One of the fireproof storerooms of the Department of Anthropology.

[*Anthropology*.—**ETHNOLOGY**.—On the attic floor of the west wing and the northwest pavilion there are thirty-three fireproof storerooms containing the ethnological study collections of more than 100,000 catalogue numbers, comprising extensive series for the Philippine Islands, Siberia, China, South Sea Islands, Africa, South Africa and the various culture areas in North America.

Archæology.—In archæology there is a large type series of stone objects from the various States of the Union. Full collections from excavated sites in British Columbia, Washington State, New York State, Kentucky, Arizona and New Mexico are here, together with a special series from the Trenton Valley. There is much material from Mexico, Peru and Bolivia.

The human skeleton material is chiefly from western States and South America. About two thousand crania have been classified and made available for study.

Geology.—The study collections comprise, among other things, the Hitchcock series of rocks illustrating thirteen geological sections across the States of Vermont and New Hampshire; a complete set of duplicate specimens from the United States geological survey of the Fortieth Parallel; a series illustrating the early geological survey of Pennsylvania; a complete typical series of rocks and microscopic thin sections illustrating Rosenbusch's manual of petrography; large series of American rocks; a complete series typifying the rocks encountered in driving the Simplon tunnel, Switzerland; many ores and economic specimens.

Invertebrate Palæontology.—Great numbers of fossil invertebrates, too numerous and varied to particularize, but representing many of the important groups and including a large number of types.

Ichthyology and Herpetology.—**ICHTHYOLOGY**.—The collection of fishes comprises about 7,000 catalogued specimens, preserved in alcohol and kept in tanks and jars.

The fossil fish collection is one of the largest, if not the largest, in America, comprising about 10,000 catalogued specimens; it includes the Newberry, the Cope and several smaller collections.

HERPETOLOGY.—The collection of frogs, salamanders and reptiles numbers 9,000 specimens.

Invertebrate Zoölogy.—**GENERAL INVERTEBRATES**.—About 60,000 specimens of protozoans, sponges, polyps, starfishes, sea-urchins, worms, crustaceans, spiders, myriapods and chordates.

INSECTS.—(a) Local collection comprising insects within fifty miles of New York City. (b) General collection including more than 500,000 specimens, among them the types of many species.

SHELLS.—The chief Molluscan collections of the Museum, exclusive

of fossils. About 15,000 species are represented, comprised for the most part of the Jay and Haines collections.

Mammalogy and Ornithology.—**MAMMALOGY.**—The study collection of mammals contains about 35,000 skins, skulls and skeletons exclusive of the material obtained by the Congo Expedition which has not yet been catalogued. It is especially rich in South American forms. Mexico and the Arctic are well represented; from the latter region there is a large and unique series of the beautiful white Peary's caribou and of the Greenland muskox, comprising about 150 specimens. The collection of whales is likewise noteworthy.

Ornithology.—The study collection of birds consists of approximately 125,000 skins and mounted birds, about nine-tenths of which are from the Western Hemisphere, and several thousand nests and eggs. South America is chiefly represented by a large collection from Matto Grosso, Brazil, and extensive collections from Colombia; also smaller series from Ecuador, Peru, Venezuela and Trinidad.

From North America, there are important collections from Mexico, Nicaragua, California, Texas, Arizona and the Middle Atlantic States—the Rocky Mountain region being most poorly represented. Of special collections, the George N. Lawrence and Maximilian collections are of special importance from the hundreds of type specimens which they contain.

Mineralogy.—Most of the mineral specimen are on exhibition, but the overflow from the public cases forms a study series of no mean proportion.

Public Health.—Living bacteria are maintained and distributed free to recognized laboratories.

Vertebrate Palæontology.—The study collections comprise about 15,000 catalogued specimens of fossil mammals, 6,000 fossil reptiles and amphibians and a few hundred fossil birds. Most of these are from the western United States. The collections of fossil horses, Eocene mammals and Cretaceous dinosaurs are unrivaled. The fossil rhinoceroses, camels, oreodonts, carnivora, Fayûm, Pampean and Patagonian mammals, Jurassic dinosaurs, Permian reptiles, turtles, etc., are likewise of the first rank. They include more than nine hundred type specimens of fossil mammals and several hundred type specimens of fossil reptiles and amphibians.

The Museum Library, located on the fifth floor, contains about 70,000
Library volumes on various branches of natural history (save botany), anthropology and travel. It is particularly strong in vertebrate palæontology and scientific periodicals. Like other museum libraries, it is of necessity a reference library, but, except on

Sundays and holidays, may be freely used by the public during the hours when the Museum is open.

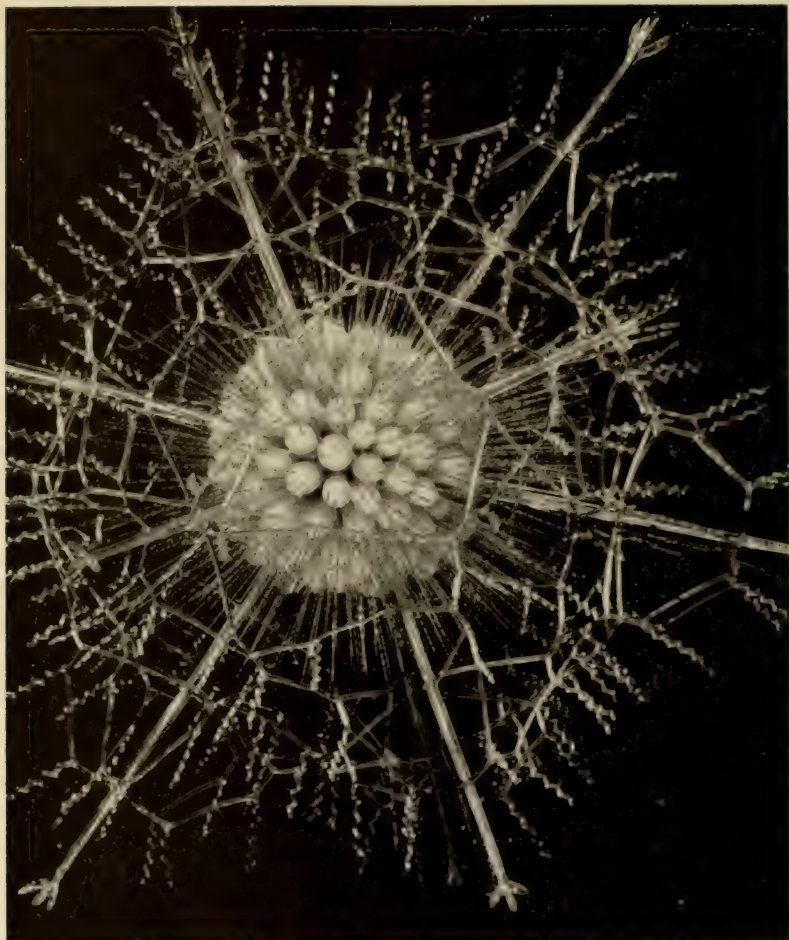
The publications of the Museum, aside from the *Annual Report*, fall naturally into two groups: scientific and popular. The **Publications** former, comprising the *Memoirs*, *Anthropological Papers* and *Bulletin*, contain information gathered by the various expeditions, or derived from the study of material collected; they are from the nature of their subjects mainly of a technical character. The *Memoirs* consist of the larger, more important papers, or those that call for unusually large illustrations. These are issued from time to time as occasion may demand. The *Bulletin* comprises the shorter papers, those that contain information that it is desirable to issue promptly, and a volume of about 400 pages is issued annually. The scientific papers are distributed, largely in exchange, to museums and libraries throughout the world.

The popular publications include the *Journal*, *Leaflets*, *Guides* and *Handbooks*, and are intended for the information of the general public. The *Journal*, begun in 1900, is the means of promptly informing the Museum Members of the work of the institution, giving the results of the many expeditions, telling of the collections made, or more important information gathered. It also describes at length interesting or noteworthy installations, and notes the accessions to the various departments, changes in the personnel of the Museum, and elections to Membership. The *Illustrated Guide Leaflets* deal with exhibits of particular interest or importance, such as the Habitat Group of Birds, the Evolution of the Horse, Meteorites, the Indians of Manhattan, calling attention to important objects on exhibition and giving information in regard to them. The *Handbooks*, four of which have been issued, deal with subjects or topics rather than objects. Thus the Plains Indians Handbook, by Dr. Wissler, is not merely a guide to the exhibition hall, but tells of the life and customs of these Indians, their language, political organization, religious beliefs and ceremonies.

The distribution of these popular publications is a part of the educational work of the Museum, as are the exhibits and lectures, and so far they have been necessarily sold below the cost of publication, as is done by other Museums. (*See list at end of this Guide.*)

An important part of the Museum, not seen by the public, is the **Workshops** workshops, located in the basement and provided with machinery of the most improved pattern. Here, among other things, are constructed the various types of cases used in the Museum, including the light, metal-frame case, devised in the institution.

Still other rooms, which, of necessity, are not open to the public, are the laboratories, wherein is carried on the varied work of preparing



ENLARGED MODEL OF A RADIOLARIAN

One of many made in the Museum laboratories.

exhibits, work which calls for the services of a very considerable number of artists and artisans.

Here are cast, modeled, or mounted the figures for the many groups from Man to Myxine, here leaves are made to grow and flowers to bloom as accessories for beasts,* birds and fishes, to say nothing of reptiles and amphibians, and here, with painstaking care, are slowly created in glass and wax the magnified copies of invertebrates.

From all this may be gathered that a museum is a very busy place, much more so than the casual visitor is apt to imagine. In fact, a very good museum man has said that a museum is much like an iceberg, seven-eighths of it under water and invisible. We will now proceed to the visible eighth.

*See *Guide Leaflet No. 34*.

Before entering the Museum one notices the "Bench Mark" established by the U. S. Geological Survey in 1911 on which is inscribed the latitude and longitude, $40^{\circ} 46' 47.17''$ N., $73^{\circ} 58' 41''$ W., and height above sea level, 86 feet.

On the right is a "pothole" from Russell, St. Lawrence Co., N. Y., formed by an eddy in the waters of a stream beneath the melting ice of the glacier that covered Northern New York. The stream carried pebbles that, whirled around by the eddy, cut and ground this hole, which is two feet across and four feet deep.

On the left is a large slab of fossiliferous limestone from Kelleys Island in Lake Erie near Sandusky, whose surface has been smoothed, grooved and scratched by the stones and sand in the bottom of the vast moving ice sheet or glacier that covered the northeastern part of North America during the Glacial Epoch. The front of this continental glacier is now thought by most geologists to have retreated northward across Lake Erie from 30,000 to 50,000 years ago. At Kelleys Island the ice was moving from east to west.

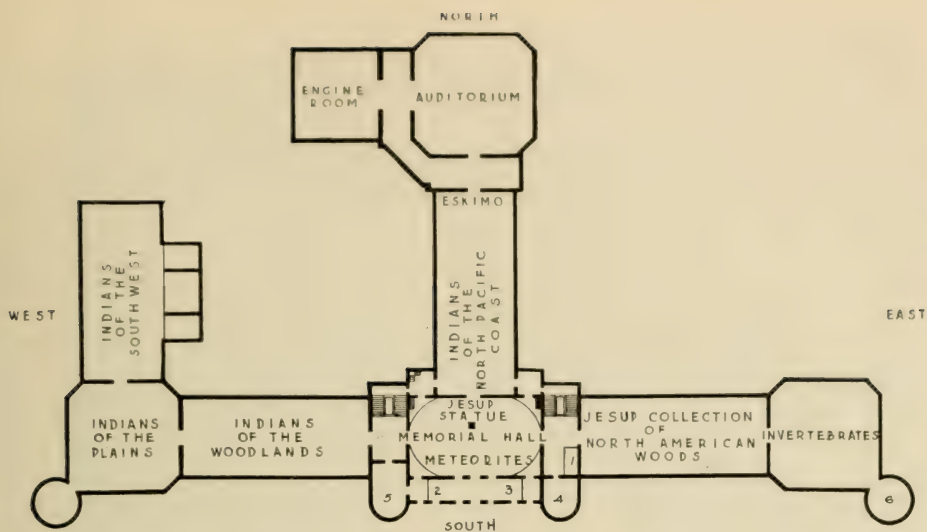


AT THE ENTRANCE TO THE MUSEUM



MEMORIAL STATUE OF MORRIS K. JESUP

Mr. Jesup, President of the American Museum of Natural History for more than a quarter of a century, was a staunch supporter of the institution's two aims: to be a great educational institution for the people and also a center for activity in scientific research.



- | | |
|-----------------------|-------------------------|
| 1. Elevators | 4. Academy Room |
| 2. Information Bureau | 5. West Assembly Room |
| 3. Visitors' Room | 6. Collection of Corals |

FIRST FLOOR

SOUTH PAVILION

MEMORIAL HALL

The *Information Bureau* and the *Visitors' Room* are on either side of the south entrance. Wheel chairs for children or adults are available without charge. Postcards, photographs, guide leaflets, and Museum publications of various sorts are for sale, and visitors may arrange to meet friends here. On the right and left of the entrance are small *Assembly Halls* in which lectures to classes from the public schools of the City are given and where the New York Academy of Sciences and other scientific societies hold their meetings.

From the lobby the visitor first enters *Memorial Hall* and faces the marble statue of Morris K. Jesup, third President of the Museum. Mr. Jesup was a founder, trustee and benefactor of the Museum and for twenty-seven years its President. Under his administration and through his liberality the Museum made rapid progress. This statute of Mr. Jesup was executed by William Couper and was presented to the Museum by the Trustees and a few other friends. The marble busts in the wall niches represent noteworthy pioneers of American science, and are the gift of Morris K. Jesup.



THE VISITORS' ROOM

Where they may rest, meet their friends, write notes or purchase publications and postcards.

These include Benjamin Franklin, statesman and natural philosopher, Alexander von Humboldt, geographer and geologist, Louis Agassiz, zoölogist, Joseph Henry, physicist, John James Audubon, ornithologist, Spencer Fullerton Baird, zoölogist and founder of the United States Fish Commission, James Dwight Dana, geologist, John Torrey, botanist, Edward Drinker Cope, paleontologist, Joseph Leidy, anatomist, and Robert E. Peary, explorer.

Memorial Hall was once the lecture hall and here thousands have listened to Professor Bickmore.

Circling this same hall is a portion of the collection of meteorites, popularly known as "shooting stars," ranging in weight from a few pounds to 36 tons. The greater number of meteorites are stony, but the more interesting ones are composed chiefly of iron, while certain meteorites contain both stone and iron. The toughness of iron meteorites is due to the presence of nickel, and the fact that they were so difficult to cut led to the adoption of an alloy of nickel and iron in making the armor plate for battleships. Meteorites have a very definite structure and when polished (see specimens on the right with electric lamp) show characteristic lines which together with their composition are to the expert absolute proof that the specimens are meteorites.

"Ahnighito" or "The Tent" at the left is the largest known meteorite in the world, and was brought from Cape York, Greenland, by Admiral R. E. Peary. It weighs 36 tons, and its transportation to New York was an engineering feat. Opposite it at the right is the curiously pitted "Willamette" meteorite from Oregon which was the subject of a famous lawsuit. The smaller meteorites will be found in the Hall of Geology, fourth floor. [The collection of meteorites is described in *Guide Leaflet* No. 26.]

**Ahnighito
Meteorite**

**Willamette
Meteorite**

SOUTH CENTRAL WING

INDIANS OF THE NORTH PACIFIC COAST

North of Memorial Hall—that is to the rear of the Jesup statue—is the *North Pacific Hall*, where are displayed collections illustrating the culture of the Indians of the northwest coast of America. These collections are arranged geographically so that in passing from south to north through the hall the visitor meets with the tribes in the same sequence that he would in traveling up the west coast of North America.

**Indians of
British
Columbia and
Alaska**



WEAVING A CHILKAT BLANKET

One of the Mural Paintings of Will S. Taylor

The most striking object is the great Haida Canoe in the center of the hall. In it is being constructed a group representing a party of Chilkat Indians on the way to celebrate the rite of the "potlatch." The potlatch is the great "giving ceremony," common to all the coast tribes when individuals and families gladly impoverish themselves that the dead may be honored, and social standing of the clan or family recognized and increased. At the stern of the canoe, which is represented as approaching the beach, stands the chief or "medicinemán," who directs the ceremony. The canoe is a huge dugout made from a single tree, is 64½ feet long and 8 feet wide and capable of carrying 40 men.

Against the pillars and walls of the hall are many house posts and totem poles with their grotesque carvings; the latter may represent either the coat of arms or family tree, or they may illustrate some story or legend connected with the family. The Haida Indians together with the Tlingit are recognized as superior in art to the other Indian tribes along the northwest coast of North America. They are divided into a number of families with various crests for each family and grouped into two main divisions, the Ravens and the Eagles. The Tlingit are makers of the famous Chilkat blankets, of which the Museum possesses an exceptionally fine collection.

**Chilkat
Blankets**

Among some of the other tribes there is little wool weaving, the clothing consisting of shredded and softened inner tree bark braided and matted together. The Indians of this region are preeminently a woodworking people, as is manifest in the exhibit. Religious ceremonies and the wearing of masks generally supposed to aid the shaman or priest in curing disease were customary among most of the tribes. The masks represented guardian spirits and by wearing them the shaman impersonated these spirits and assumed their powers in healing the sick or obtaining game.



Totem pole at Wrangel, Alaska. At the bottom is a beaver with a frog under his chin; above is a raven; and above the raven a frog, which is surmounted by a human head.

The mural decorations by Will S. Taylor between the windows on both sides of the hall represent the industries and ceremonies of the Indians of this region. Those at the north end of the hall by Frank Wilbert Stokes relate to the Eskimo and their country.

The Eskimo collections are being arranged in the adjoining hallway and corridor. Here is a group showing the Eskimo woman cooking in the interior of a snow hut or igloo lined with sealskin. She is using a stone lamp filled with seal oil, which feeds the flame over which the



ESKIMO HOME SCENE

There are two instructive groups near the entrance to the Auditorium. In one, a home scene within a snow house or "igloo," an Eskimo woman is cooking blubber over the flame from a seal-oil lamp; the other represents an Eskimo woman fishing through the ice. The Museum is rich in Eskimo collections.

meal is being prepared. Nearby is an Eskimo woman fishing through the ice. She has formed a windbreak with blocks of ice. The fish-rod and hook, and the long ladle are made of bone, and with this latter she keeps the water in the hole from freezing over while she is fishing. In this section will be found collections obtained by the Stefansson-Anderson expedition from the Eskimo of Coronation Gulf, some of whom had never seen a white man. In other cases are shown the clothing of the Eskimo, the many ingeniously made implements, and many finely carved and engraved ivory objects.

The doorway at the north end of the hall leads to the *Auditorium*, which has a seating capacity of 1,400, and is equipped with two screens, 25 feet square, for stereopticons. Free public lectures are given here Tuesday and Saturday evenings from October to May under the auspices of the Board of Education. There are also special lectures for Members of the Museum as well as lectures for school children. At the entrance of the lecture hall is appropriately placed a bust of Professor Albert S. Bickmore, originator of the movement that resulted in the erection of the Museum, first curator, and founder of its lecture system.

At the end of the corridor is the power room, where may be seen demonstrated the transformation of the potential energy of coal into heat, light and motion.

WEST CORRIDOR

To the right or west of the Jesup statue are three halls devoted to Indian collections. To reach these the visitor passes through the *West Corridor*, which is devoted to the temporary display of recent acquisitions or small collections of particular interest. Opening from this is the West Assembly Hall, frequently used for temporary exhibitions as well as meetings.

On the landing, at the head of the stairway, is the William Demuth collection of pipes and fire-making appliances from many parts of the world.

SOUTHWEST WING

INDIANS OF THE WOODLANDS

The halls to the west contain collections from the North American Indians and together with the hall in the south central wing present the nine great culture areas of North America.

(See map on the right of the entrance.)



A MOHAWK CHIEF FROM THE MOHAWK VALLEY

From an engraving in the collection of the New York Historical Society.

The hall you now enter represents three of these culture areas. Filling the greater part of the hall are the tribes of the Eastern Woodlands who occupied the middle portion of the North American continent east of the Mississippi. In two wall cases on the left are exhibits of the Mackenzie region of the North and of the related tribes in Alaska west of that region. Midway of the hall on the right side are represented the peoples of the Southeast.



Decorated birchbark vessel of the Penobscot Indians.

Near the entrance of the hall will be found the remains of our local Indians.

On the left are some specimens of pottery vessels and many small objects of stone and bone recovered from the Island of Manhattan and the neighboring territory of Staten Island, Long Island, and Westchester. Nearby on the same side of the hall are collections obtained from living Indians of the coast region north and south of New York. These are the Penobscot and Passamaquoddy of Maine, the Micmac and Malecite of the lower provinces of Canada, and a few but rare objects from the Delaware who once occupied the vicinity of New York City and the State of New Jersey.

On the opposite side, the north, are the Iroquois whose league comprised the Mohawk, Seneca, Oneida, Onondaga, Cayuga and later the Tuscarora. They dominated New York and much adjoining territory. The exhibits represent particularly the agriculture of the East, which was carried on with rude tools by the women.

In a case in the aisle are exhibited wampum belts which were highly esteemed in this region. They served as credentials for messengers and as records of treaties and other important events. Later wampum beads came to have a definite value as currency, especially in trade between the white men and the Indians.

In the farther end of the hall, on the left, are the collections from the Ojibway, Hiawatha's people, who lived mainly north of the Great Lakes. They had but little agriculture, living chiefly by hunting and fishing. Beyond the Ojibway are the Cree, who live still farther north. Here is to be seen the rabbit skin clothing of our childhood rhymes.

Opposite the Ojibway are the great Central Algonkian tribes, the Menomini and Sauk and Fox, who lived south and west of the Great Lakes. They gathered wild rice and hunted and fished, practicing also some agriculture. In one of the Menomini cases are some skin bags

beautifully worked in porcupine quills. These bags were used in the Midewin, the secret society of the shamans.

The dwellings are of several forms, among which may be mentioned the long rectangular houses of the Iroquois covered with oak-bark; the dome-shaped huts of Long Island and vicinity which were covered with mats and bundles of grass; and the familiar conical wigwam of the Ojibway covered with birchbark. The utensils are of pottery, wood or birchbark. Pottery was not made by all the Eastern tribes and seems to be associated with the practice of agriculture. The designs are incised, never painted. Bowls, trays, and spoons are made of wood and often decorated with animal carvings. The use of birchbark in the construction of light, portable, household vessels is a particular trait of our Eastern Indians.

In the southeastern portion of the United States agriculture was highly developed. These tribes are represented by the Cherokee and Yuchi who made pottery, and by the Choctaw and Chitimacha who have interesting baskets made of cane. The Seminoles of Florida have maintained an independent existence in the Everglades for nearly a century. Their picturesque costumes are shown.



A DANCER OF THE DOG SOCIETY
Arapaho Indian.

SOUTHWEST PAVILION

INDIANS OF THE PLAINS

The collections from the Indians of the Plains will be found in the hall adjoining. These Indians comprised the tribes living west of the

Mississippi and east of the Rocky Mountains as far south as the valley of the Rio Grande and as far north as the Saskatchewan. (See map on south wall.)

Occupying the greater part of the hall beginning on the left are the buffalo hunting tribes: the Plains-Cree, Dakota, Crow, Blackfoot, Gros Ventre, Arapaho and Cheyenne. These tribes did not practise agriculture but depended almost entirely on the buffalo; buffalo flesh was their chief food, and of buffalo skin they made their garments. In some cases a buffalo paunch was used for cooking, and buffalo horns were made into various implements of industry and war. The spirit of the buffalo was considered a powerful ally and invoked to cure sickness, to ward off evil, and to give aid in the hunt. Whenever the buffalo herds led the way, the more

**Indians of the
Plains**



A DOG FEAST OF THE SIOUX

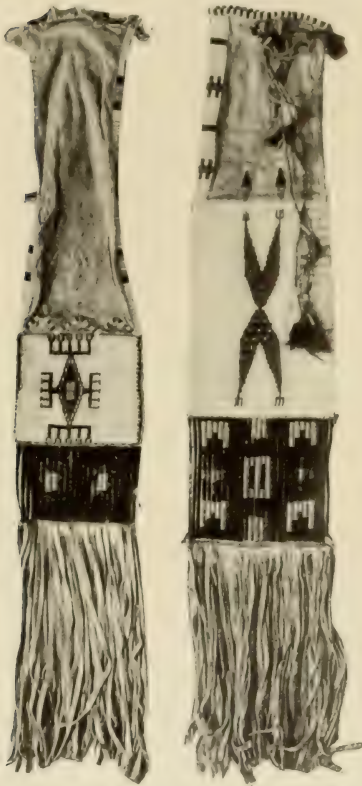
Given in honor of Mr. Sanford, Pierre Choteau and Catlin. From the Catlin Collection of paintings.

nomadic Plains tribes moved their tents and followed. With the extermination of the buffalo the entire life of the Plains Indians was revolutionized.

On the right, near the entrance, are the village tribes of the Plains; the Mandan with whom Lewis and Clark passed the winter of 1804-1805, the Hidatsa who now live with them, and the Omaha, Kansa, Iowa and Pawnee. All these tribes raised corn and lived in earth covered houses of considerable size. A small model of one of these houses stands near the exhibits.

In the center of this hall is a Blackfoot Indian tipi with paintings of otters on the sides, representing a vision of the owner. This tipi has been fitted up to show the home life of a typical buffalo hunting Indian.

Blackfoot
Tipi



PIPE AND TOBACCO BAGS

Dakota Indians.

Medicine bundle, belonging to a leading man of the Blackfoot tribe (medicine man), together with the headdress which he wore in ceremonies, is in a case near the tower.

The Plains Indians are noted for their picture writing on skins and for their quillwork, which has now been superseded by beadwork. They have a highly developed decorative art in which simple geometric designs are the elements of composition, this being one of the most interesting features of their art. (See Dakota case.) [See *Handbook No. 1. North American Indians of the Plains.*]

There were numerous soldier societies among the Plains Indians which included

practically all the adult males. Each society had a special dance and special costumes. (See the Arapaho cases for costume dances.) There were other dances connected with tribal religious ceremonies, the best known and most

important of which is the sun dance, illustrated by a model at the left of the tipi. The

sun dance was held annually in the early summer in fulfillment of a vow made during the preceding winter by some member of the tribe who wished a sick relative to recover. The dance involved great physical endurance and excruciating selftorture, lasting three days, during which time the dancers neither ate nor drank.

In the center of the hall is a genuine medicine pipe, held in awe by the Indians and dearly parted with;

also the contents of a medicine pipe bundle. The contents of another medicine

Medicine
Pipe

WEST WING

INDIANS OF THE SOUTHWEST

On the left are collections from the sedentary Indians who occupy the pueblos of the Rio Grande and of Hopi, Acoma and Zuñi; and also the objects recovered from the prehistoric pueblos, caves, and cliff-dwellings. On the right are the nomadic Indians—the Eastern and Western Apache, the Navajo, the Pima and the Papago.

The sedentary Indians live in large community houses, often with several receding stories, built of stone or adobe. They depend chiefly upon agriculture for their food, make a great variety of pottery, and have many elaborate religious ceremonies. The nomadic peoples live in tipis or small brush and thatched houses which are moved or deserted when they are forced to seek the wild game and wild vegetable products which furnish much of their food. They make baskets for household purposes which are more easily transported than vessels of clay. There are models in the hall of the pueblos of Taos and Acoma, of prehistoric cliff-dwellings and of the houses used by the Navajo. In the first alcove on the left is shown the pottery of the villages along the Rio Grande, the principal art of the region, skin clothing, household utensils and ceremonial objects.

The upright cases of the next alcove are filled with wonderful prehistoric pottery. That in the wall case is from Pueblo Bonito. Similar gray and white ware with very elaborate and splendidly executed designs in an adjoining case are from Rio Tularosa, one of the upper tributaries of the Gila, where a vanished agricultural people once lived in pueblos and cliff-dwellings. A third case has material gathered by the Museum expedition now exploring Galisteo Valley, New Mexico. In the table case and in a case standing in the aisle are shown the wonderful art work in turquoise, shell, stone and wood of the former inhabitants of Chaco Cañon. These objects, as well as the pottery from Pueblo Bonito mentioned above, were secured by the Hyde expedition.

In the next alcove, devoted to the Hopi, are the costumes, masks, images, and plaques used in their ceremonies. Besides the well-known snake dance, the various Hopi villages have many interesting ceremonies, many of which are concerned with the rainfall and their crops.

The inhabitants of Zuñi are believed to be the descendants of the first people seen by the Spanish in 1540. Their former villages, many of which now are in ruins, were probably the "Seven Cities of Cibola," for which Coronado was searching at that time. Although they had



A PART OF THE HOPI GROUP

missionaries among them for about three centuries, they have retained many of their own religious ceremonies. Many objects pertaining to these ceremonies as well as to everyday life are shown in this alcove. In the last case on this side of the hall are examples of Zuñi and Acoma pottery.

At the north end of the hall opposite the Zuñi, space is given to an exhibit from the tribes of California. In the large end wall case the baskets of the region are arranged so as to show the various types.

The Pima, east side of the hall, practiced irrigation, raising by its aid the corn and beans on which they relied for food and the cotton which they used for their scanty garments. The Pima
Papago, with whom they are closely associated, occupied the more arid portions of southern Arizona and northern Sonora, securing their living from such desert products as the giant cactus, the century plant, the yucca and the mesquite and small game. Examples of their food, basketry, pottery, and ceremonial articles are shown.

From the aisle near the Pima-Papago section one catches a glimpse of the home of the Hopi. This large group represents the First Mesa with the village of Walpi. The canvas was painted by Howard McCormick and the figures were modeled by Mahonri Young.

The Navajo, a large and widely scattered tribe, inhabit much of the country drained by the San Juan and Little Colorado
rivers. During the winter they occupy houses like the one standing in the large annex, but in milder weather camp with the slight shelter of a cliff or a windbreak and shade made of brush. They live by raising corn in the moist valley and on the flesh of their numerous flocks of sheep.

They are the present-day blanket makers of North America. They make use of the wool of the sheep they raise, carding, spinning, and weaving it by means of the simplest implements and looms. This art is believed to have arisen since the coming of the Spanish and it is known to have passed through several stages in the last sixty years. The older types of blanket here shown contain yarn which was obtained by cutting or ravelling from imported flannels, called in Spanish "bayeta," from which the blankets of this sort receive their name. These are either bright red or old rose in color, resulting from cochineal dye. Several blankets are made of yarn bought ready dyed from the traders and are called German-towns. The greater number, however, contain yarn of native spinning, dyed with native vegetable and mineral dyes.

The Navajo are also expert silversmiths. Their tools and samples of workmanship are displayed in a case in the center of the hall.

The Western Apache live along the upper portion of the Gila and

Salt rivers, where they practice agriculture, gather the wild products and hunt. These were the people who, under Geronimo, Apache raided the settlements of southern Arizona and northern Mexico and evaded our troops for years. They live in grass-thatched houses or in the open under the shade of flat-topped, open-sided shelters. In an adjoining alcove is being prepared an industrial group with painted background showing the well-watered San Carlos valley occupied by the Apache for many generations.



An attractive Navajo blanket from the Museum's valuable collection. The Navajo Indians of the Southwest are a wealthy, pastoral people, and the best Indian blanket makers of North America.

The Eastern Apache lived in buffalo-skin tipis. They went far out on the plains in search of the buffalo herds, avoiding, if possible, the plains tribes, but fighting them with vigor when necessary. In dress and outward life they resemble the Plains Indians, but in their myths and ceremonies they are like their southwestern relatives and neighbors. The baskets of the Apache are shown in the large end case, which is in contrast with the corresponding case of pottery on the other side of the hall. Not the environment but social habits caused one people to develop pottery and the other to make the easily transported and not easily breakable baskets. [See *Handbook*, Indians of the Southwest.] [Return to the *Jesup Statue*.]

EAST CORRIDOR

POLAR MAPS

Leaving the statue on the left and "Willamette" meteorite on the right, and going east, the visitor enters the corridor where the elevators are located (*East Corridor*). Here will be found maps of the north and south polar regions showing the routes of explorers. On the wall are sledges used by Admiral Peary in his last three expeditions in search of the North Pole. The Morris K. Jesup sledge, which the Admiral used in his successful polar expedition is the one nearest the entrance. The various sledges in their differences of style show the persistent effort made by Admiral Peary to bring the sledge up to its greatest possible usefulness. That he was successful on his last trip was in part due to the final modification.

On the opposite side of the map is one of the sledges used by Amundsen on his journey to the South Pole. [A history of south polar expeditions is given in *Guide Leaflet* No. 31.]

In a room at the north end of this corridor is the large Mainka seismograph for recording the occurrence of earthquakes. This was given to the New York Academy of Sciences by Emerson McMillin, and by the Academy deposited in the Museum.

SOUTHEAST WING

JESUP COLLECTION OF NORTH AMERICAN WOODS

To the east of the elevators is the *Hall of North American Forestry* containing the Jesup Collection of North American Woods, a nearly complete collection of the native trees north of Mexico, presented to the Museum by Morris K. Jesup. On the right is a bronze tablet, by J. E. Fraser, the gift of J. J. Clancy, depicting Mr. Jesup as he walked in his favorite wood at Lenox, Mass.

To the left is a section of one of the Big Trees of California, sixteen feet in diameter and 1341 years old. [See *Guide Leaflet* No. 42.] It began its growth in the year 550, so that it was nearly a thousand years



WILD PLUM IN THE FORESTRY HALL

Each of the five hundred species of trees in North America is represented by a section of trunk five feet long, some of a diameter not found in the country's forests to-day. Many of the specimens are accompanied by wax models of leaves, flowers and fruits accurately reproduced from life.

old before America was even discovered. The specimens show cross, longitudinal and oblique sections of the wood finished and unfinished, and the labels on the specimens give the distribution of the species, the characteristics of the wood and its economic uses. The trees are grouped by families and the location of each family will be found on the floor plan at the entrance of the hall. The reproductions of the flowers, leaves and fruits in natural size are instructive. This work is done in the Museum laboratories. Note the character of forests as shown by the transparencies.

SOUTHEAST PAVILION

INVERTEBRATES

At the extreme east is the *Darwin Hall*, devoted chiefly to the invertebrate animals (those which do not possess a backbone) and to groups illustrating biological principles. Facing the entrance is a bronze bust of Darwin by Wm. Couper, presented by the New York

Synoptic Series

Academy of Sciences on the occasion of the Darwin centenary in 1909. Passing around the hall from left to right the progression is from the lowest forms of animal

life, the one-celled Protozoa, to the highest and most complex forms of animal life, the Primates, including man. The distinctive characteristics of each group are fully described on the alcove and case labels. Many of the minute forms are represented by skilfully prepared models in glass and wax showing the animal many times enlarged. Thus the visitor may obtain an idea of the form and structure of these animals which in spite of their small size have in so many instances such a vital influence on the life of man.

This alcove contains the lowest forms of animal life. All are single-celled individuals. The simplest kinds are abundant in swamps and stagnant water, others are found in myriads in the sea, while the ocean bottom in many localities is covered with them. The specimens exhibited in this alcove are mainly models, some of which are enlarged more than a thousand diameters.

Alcove I Protozoa

Sponges are principally of two kinds—those with skeletons or supporting structures of silica (i. e. flint) and those with skeletons of horny fiber. The sponges of commerce belong to the latter class. In the dry specimens exhibited the skeleton only can be seen, the living tissue having been removed. Many of the “glass” sponges are very

beautiful in design. Sponges range in size from the tiny *Grantia* of the New England coast to the gigantic "Neptune's goblets" found in the eastern seas. This alcove contains certain specimens whose tissue is represented in wax tinted to

show the natural coloring of sponges, which varies from the bleached yellowish color commonly seen to deep brown or black, or yellow and red, in varying shades.

In Alcove 3 are shown coral animals and their relatives: plantlike hydroids which often are mistaken for sea moss, but which really are a series of polyps

Alcove 3 Polyps

living in a colony; jellyfishes with their umbrella-shaped bodies and long, streaming tentacles; brilliant colored sea anemones, sea fans and sea plumes; the magenta colored organ-pipe coral, the stony corals, and the precious coral of commerce. Coral polyps, mistakenly called "coral insects," are the animals that build up the coral reefs. In front of the window is a life-size model in glass of the beautiful Portuguese Man-of-War. This organism is really a colony of many polyp individuals attached to one another, and specialized for various functions.

Alcove 4 Flatworms

The best known species in this group include the tape-worms, whose development and structure are shown by models in the central case and in the third section of the left-hand alcove case. These are parasitic flatworms. The less familiar free-living flatworms, which inhabit both salt and fresh water, are shown by enlarged models in the right-hand alcove case and illustrate well the great diversity of color and detail in this group.

The Roundworms are also parasitic, since they live in the digestive canal of mammals. The most familiar is the common roundworm or stomach worm, *Ascaris*, of which an enlarged model is exhibited, showing the internal structure.

Alcove 5 Roundworms

[Note for teachers and students,—Some of the models



European commercial sponge comparable with the Florida yellow sponge or "Hardhead." The sponge industry in both the Mediterranean and the Bahama region is almost destroyed by careless methods, and conservation must be practiced here as in other of the world's resources.

in each alcove are *anatomical*, i. e. so constructed as to show the internal organs of typical members of each group. In such cases, arbitrary colors chosen to designate the various systems of organs are adhered to consistently throughout the series. For example, the digestive system is shown in yellow, heart and blood-vessels in red, organs of excretion (kidneys) in green, reproductive system in gray, and the brain and other parts of the nervous system in black or neutral color.]

The minute wheel animalcules comprise many exquisite and grotesque forms, some of which construct tubes of gelatinous substance, sand-grains, etc. A few of the species are parasites, but most of them live a free, active life. They are aquatic and found mainly in fresh water.

The sea-mats in Alcove 7 are plant-like animals which lead the colonial form of life. The majority of the species are marine, although a few occur in fresh water. The lamp-shells shown in this alcove superficially resemble clams, but by structure are more closely related to the worms and starfishes.

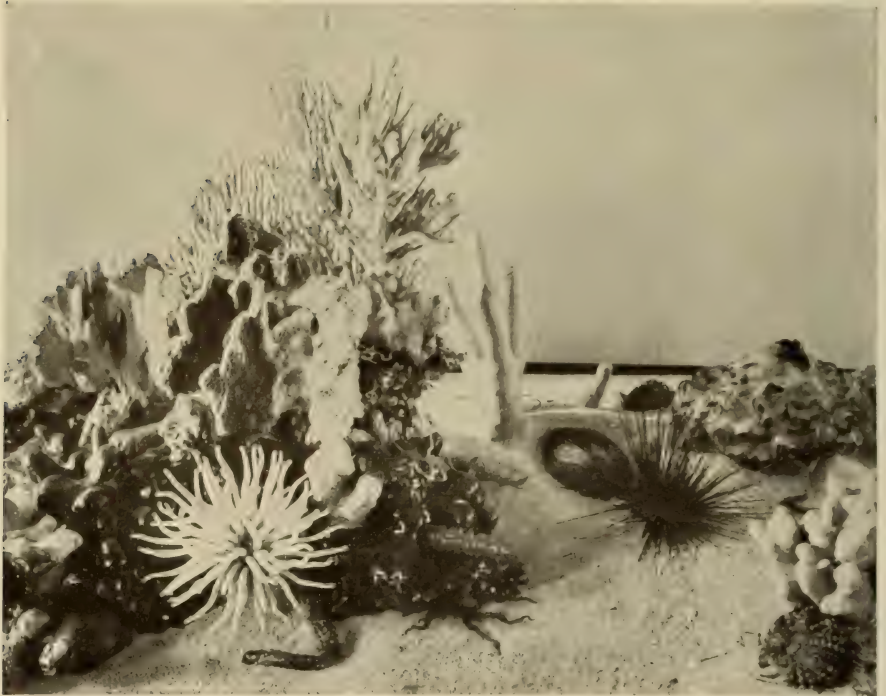
Alcove 8 is occupied by the sea stars, sea urchins, sea-cucumbers and sea lilies. The sea-star is the pest of the oyster beds, where it feeds on oysters and destroys them in large numbers. The brittle stars are so called because of their habit of dropping off one or more arms when handled or attacked. These, however, are later regenerated.

The annulates, typified by the familiar earthworm, are worms whose bodies are made up of rings or segments. They are inhabitants of both fresh and salt water, many kinds living in the mud and sand of the shore while others bore into wood and shells. The marine annulates are often very beautiful in color and greatly diversified in form and habits, as illustrated by the models, many of which are greatly enlarged. The "houses" that these annulates build are often very beautiful and interesting. In the window is a group showing a section of mud flat on the New England coast, with the variety of worm-life found in what to the casual observer seems to be an uninhabited area, and illustrating some of their habits.

Arthropods include the familiar crabs, lobsters, insects and their relatives. The number of existing species in this group is greater than that of all the rest of the animal and vegetable kingdoms together. No other group comprises so many species useful or harmful to man. In the case in the center of the alcove is a model showing the anatomy of the

common lobster, also enlarged models showing heads of various species of insects. On the wall are the two largest specimens of lobster that have ever been taken. They weighed when alive thirty-one and thirty-four pounds

**Crustaceans
and Insects**



Marine Habitat Group. A community of starfishes, sea anemones, sea urchins and sponges as seen below the edge of a coral reef in the Bahamas.

respectively. The largest of the arthropods is the giant crab of Japan, which, like that placed on the wall, may have a spread of about ten feet. The main exhibit of insects is displayed on the third floor.

The mollusks form a group second only to the arthropods in the vast number and diversity of forms which it embraces, including marine, fresh-water and land animals. All mollusks have soft bodies, but nearly all of them secrete a shell which in many species is of pearly material (mother-of-pearl). Well-known examples of this group are the common clam and oyster and enlarged models in the center case show the anatomy of these species. A large collection of mollusks is shown on the third floor.

**Alcove 11
Mollusks**

**Models of
Clam and
Oyster**

Vertebrates include the largest, most powerful and most intelligent of animals. This group culminates in man, who still bears witness to his chordate ancestry in the retention of a chorda (cartilaginous spine), and gill clefts during embryonic life. Among these ancestral forms are the Ascidians, or Sea-squirts, an enlarged model of which is shown in the central case, while others are seen among the animals on the wharf-piles in the window group. Other models in the central case show the development of the egg of typical vertebrates.

In the circular tower alcove in the southeast corner of the hall is a comprehensive synoptic series of stony corals. Central cases in this tower and at its entrance show unusually large specimens, while a magnificent example of madreporal coral six feet in diameter is shown to the rear of the bust of Darwin. The associations of marine life found in the Bahamas are represented by several small groups in the center of the hall.

Here also four large models show the mosquito, which is the active agent in the spread of malaria. These models represent the insect enlarged seventy-five diameters or in volume four hundred thousand times the natural size. The mosquito in its development undergoes a metamorphosis. The model at the left shows the aquatic larval stage; the larvæ are the "wrigglers" of our rain-water barrels. The next model is the pupal stage, also aquatic. The third model is of the adult male mosquito, which is harmless, since it never bites man. The fourth model shows the adult female mosquito in the attitude of biting. It is so arranged as to show the internal organs, thus illustrating a typical insect anatomy. In another case is a series of models showing the life cycle of the malaria germ in the blood of man and in the mosquito.

In several of the alcove windows are habitat groups of invertebrates illustrating the natural history of the commoner and more typical animals.

In the Annulate Alcove is shown the Marine Worm Group, reproducing these animals with their associates in their natural surroundings, as seen in the harbor of Woods Hole, Mass. The harbor and the distant view of Woods Hole village with the U. S. Fish Commission buildings are shown in the background, represented by a colored photographic transparency. In the foreground the shallow water of the harbor near the shore is represented in section to expose the animal life found on muddy bottoms among the eel-grass, as well as the chimneys of various worm-burrows. In the lower part of the group a section of the sea bottom

Alcove 12
Chordates
Including
Vertebrates

Corals

Models of
the Malaria
Mosquito

Window
Groups

Marine Worm
Group



A PART OF THE WHARF PILE GROUP

exposes the worms within the burrows. Several species of these are represented.

In the Mollusk Alcove window is shown the natural history of a sand-spit at Cold Spring Harbor, Long Island, including some of the shore mollusks and their associates. The entrance of the harbor is seen in the distance. In the foreground at the edge of the sand-spit a mussel-bed is exposed by the receding tide over which fiddler-crabs are swarming into their burrows. Beneath the water surface an oyster is being attacked by a star-fish, while crabs and mollusks of various species are pursuing their usual activities.

The window group in the Vertebrate Alcove shows the piles of an old wharf at Vineyard Haven, Mass. Below the low-tide mark the submerged piles are covered with flower-like colonies of invertebrate animals. Among these are sea-anemones, tube-building worms, hydroids, mussels, seamats and several kinds of ascidians or sea-squirts. The latter are primitive members of the Chordate group which includes the vertebrates. Like the embryo of man, they possess during their larval period a chorda or cartilaginous spine. At first they are free swimming but later in life many of their organs degenerate and they become fitted to a stationary mode of life.

Other exhibits illustrate certain facts made clear by Darwin, and those who came after him. On the left facing the entrance variation under domestication is illustrated by dogs, pigeons, and domesticated fowls, the wild species from which they have been derived being shown in company with some of the more striking breeds derived from them.

On the right, various exhibits will show variation in nature. An example of this is the variation among the finches of the genus *Geospiza* in the Galapagos Islands.

Other examples show by means of a series of mollusks the range of color variation within a single species of West Indian Sun Shell, variation of sculpture within a single genus of land snail, and oscillation of variations about the normal type of the common scallop.

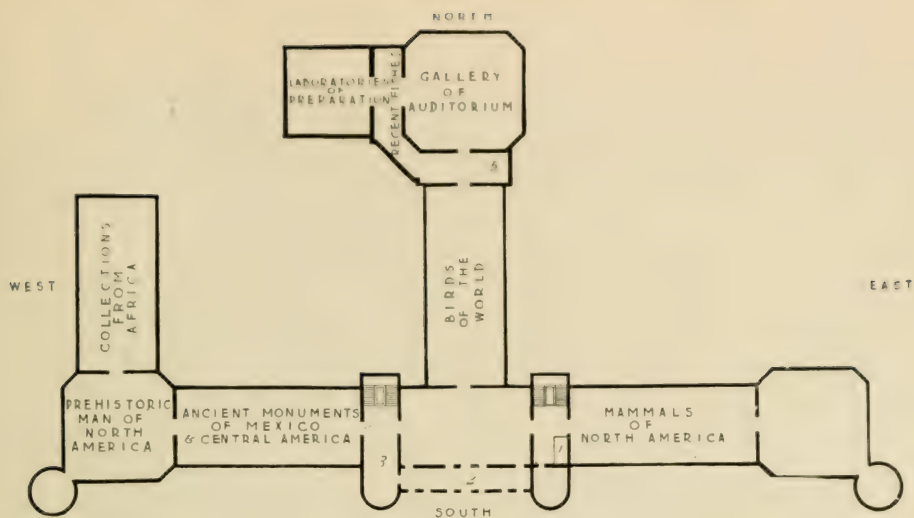
The struggle for existence is portrayed by the meadow mouse, surrounded by its many enemies and yet continuing to maintain an existence by virtue of its great birth rate.

The simpler features of the laws of Heredity as elucidated by Mendel and his followers are illustrated by the inheritance of seed-coat color in the common pea, the color of sweet peas, and the coat-color of rats as shown in a series of panels in the neighboring case.

[Return to the elevators.]



KING PENGUINS FROM SOUTH GEORGIA



1. Elevators.

2. Copies of Maya Monuments.

3. Local Birds.

SECOND FLOOR

SOUTH PAVILION

This hall illustrates a phase of Museum progress, the temporary disorder that precedes an ultimate change for the better. At present the hall contains a mixed assemblage of animals brought hither from other halls in process of rearrangement; later it is hoped that it will contain a series of groups of birds from various parts of the world.

The group of king penguins from South Georgia Island is one of four devoted to the bird life of South America, but is at present provisionally installed, awaiting important changes in hall and cases.

The Asiatic elephant is the famous "Tip" brought to this country in 1881, and for seven years one of the attractions of Forepaugh's circus. He was given to the City of New York by Mr. Forepaugh and lived in the Central Park Menagerie until 1894 when, because of his treacherous disposition, it was found necessary to kill him. He is said to have caused the death of several of his keepers, and was twenty-three years old when killed.

Here, awaiting the construction of a new wing, is exhibited the collection of reptiles and amphibians. Because of the difficulty of preserving the natural covering of many of these animals they are usually exhibited in jars of alcohol. In the specimens on exhibition here the perishable parts have been cast in wax from

**Elephant
"Tip"**

**Reptiles and
Amphibians**



LOWER CALIFORNIA LIZARD GROUP

Showing the characteristic animal and plant life of one of the small desert islands off the coast of Lower California. The material for this group was collected by the "Albatross Expedition" of 1911, under Dr. C. H. Townsend.

life; for example, in the star tortoise the original "shells" of the specimens are used, while the head, neck and legs are restored in wax. The mounting not only brings out the principal features of the species exhibited, but in many instances illustrates also some distinctive habit of the animals; for instance, the common newt, one of the salamanders, is represented by a series of five life-size casts showing the process of shedding the skin; Pickering's hyla or the "spring peeper" is shown with vocal sacs inflated; the poisonous bushmaster is represented with its eggs, and so on.

The classification of these animals is shown in the upright cases; the groups in the center of the hall represent various reptiles as they appear in their natural haunts. They include the tuberculated iguana, the water moccasin, the diamond-backed rattlesnake, the Texas rattlesnake, the copperhead, the Gila monster, the pine snake, the box tortoise and the common painted turtle.

One of the most interesting of the groups is a jungle scene in India showing a water monitor, which is the largest of living lizards, the
Cobra Group poisonous Russell's viper and the deadly spectacled cobra, the last with hood distended and poised ready to strike. The cobra is said to be the cause of a large proportion of the 20,000 deaths which annually occur in India from snakebite. Examine carefully the group of the copperhead snake or "red-eye," one of the two
Copperhead Snake Group species of poisonous snakes to be found in the vicinity of New York, and also the group contrasting the harmless watersnake with the poisonous water moccasin of southern cypress swamps. Two groups are devoted to rattlesnakes, which are easily recognized by the string of rattles at the end of the tail, by means of which they give warning before they strike. There are comparatively few species of poisonous snakes in the United States—about sixteen in all—comprising rattlesnakes, the moccasin, copperhead and two kinds of coral snake. All other species are harmless and in spite of the almost universal prejudice against them are very useful allies of man, since they live chiefly on rats, mice and insects injurious to crops.

Entering the darkened room nearby we find a group of unusual interest, showing the common bullfrog of North America.
Bullfrog Group This group is a study of the bullfrog undisturbed in its typical haunt. It illustrates the changes from the tadpole to the adult frog and shows many of the activities of the frog—its molting, swimming, breathing under water and in air, croaking, and "lying low" before an enemy; also its food habits in relation to small mammals, to birds, snakes, insects, snails, to small fish and turtles.

Another group is the Great Salamander or Hellbender, best known in

the creeks of western Pennsylvania. The group pictures them at breeding time, and shows their characteristic stages and habits: thus one of the salamanders is pictured molting, another, a male, is brooding a great mass of eggs; and the group explains many details of their manner of living.

This, the last and most beautiful of the series, depicts the spring life



A BIT OF THE TOAD GROUP

Toad of a little Group pond in southern New England. In the water may be seen the egg masses and tadpoles of various toads and frogs, while in and about the pool are the young and full grown in characteristic poses, including some with air sacs distended in the act of "singing." Among these are the toad, the spring peeper, and the familiar tree toad. A bough of apple blossoms overhangs the water while all around the spring flowers are in bloom.

Lower California In-
striking con-
Lizards trast to
these water loving
animals is a group
of reptiles from one
of the islands off
the coast of Lower
California that go
without water
entirely.



THE AMERICAN ROBIN—ONE OF THE GROUPS OF LOCAL BIRDS

WEST CORRIDOR

LOCAL BIRDS

Adjoining the *South Pavilion* is the *West Corridor*, which contains the collections of local birds.

In this room are specimens of all the species of birds which have been known to occur within fifty miles of New York City. As far as possible each species is shown in all its different plumages. In the wall cases nearest the entrance on both sides is the *General Collection* of all birds likely to be seen within this area, arranged according to the current American system of classification. Near the windows are cases containing the *Seasonal Collection*, one section containing the permanent residents while others have their contents changed each month so that they may show always the birds present at the time. In another section are the stragglers from other parts of the country and from other countries which have been taken within our limits.

Besides the table case containing the eggs (often with the nest) of species known to nest within fifty miles of the City and the collection of



THE AZTEC GODDESS OF THE EARTH

The famous statue of the Aztec Goddess of the Earth called Coatlicue, "The Serpent-skirted One," is a striking example of barbaric imagination. It was found in Mexico City near the Cathedral in the year 1791. It doubtless occupied an important place in the great ceremonial center of Tenochtitlan, the Aztec capital, and probably dates from the last quarter of the 15th century.

The head, which is the same on front and back, is formed by two repulsive serpent heads meeting face to face. The feet are furnished with claws, but the arms, which are doubled up with the elbows close to the sides, end each in a serpent's head. The skirt is a writhing mass of braided rattlesnakes. The creature wears about the neck and hanging down over the breast a necklace of human hands and hearts with a death's head pendant in the center. Coatlicue seems to have been regarded as a very old woman and as the mother of the Aztec gods.

photographs showing many of them in nature, there are down the middle of the room a series of groups of local breeding birds with their nests. These, the forerunners of our "Habitat Groups," were the first of their kind made for the Museum. [See *Guide Leaflet* No. 22.]

SOUTHWEST WING

ANCIENT MONUMENTS OF MEXICO AND CENTRAL AMERICA

Continuing west past the collection of local birds we enter the southwest wing, devoted to the ancient civilizations of Mexico and Central America. As the hall is approached easts of large upright stones appear completely covered by sculpture. These stones, called stelae, are found chiefly near Copan in Honduras and represent the highest art of the Maya civilization.

At the left of the entrance on the south side of the hall is the extensive exhibit from Costa Rica of Mr. Minor Keith. This includes stone sculpture and a great variety of pottery interesting in form and design. To this collection also belongs the gold and jade from Costa Rica arranged in the cases in the center of the hall.

On the south wall is a copy of the painted sculptures of the Temple of the Jaguars at Chichen Itza. Here are shown warriors in procession who seem to be coming to worship a serpent god. Prayers are represented as coming from their lips. This sculpture while Maya, shows strong evidence of Mexican influence in certain of its details.

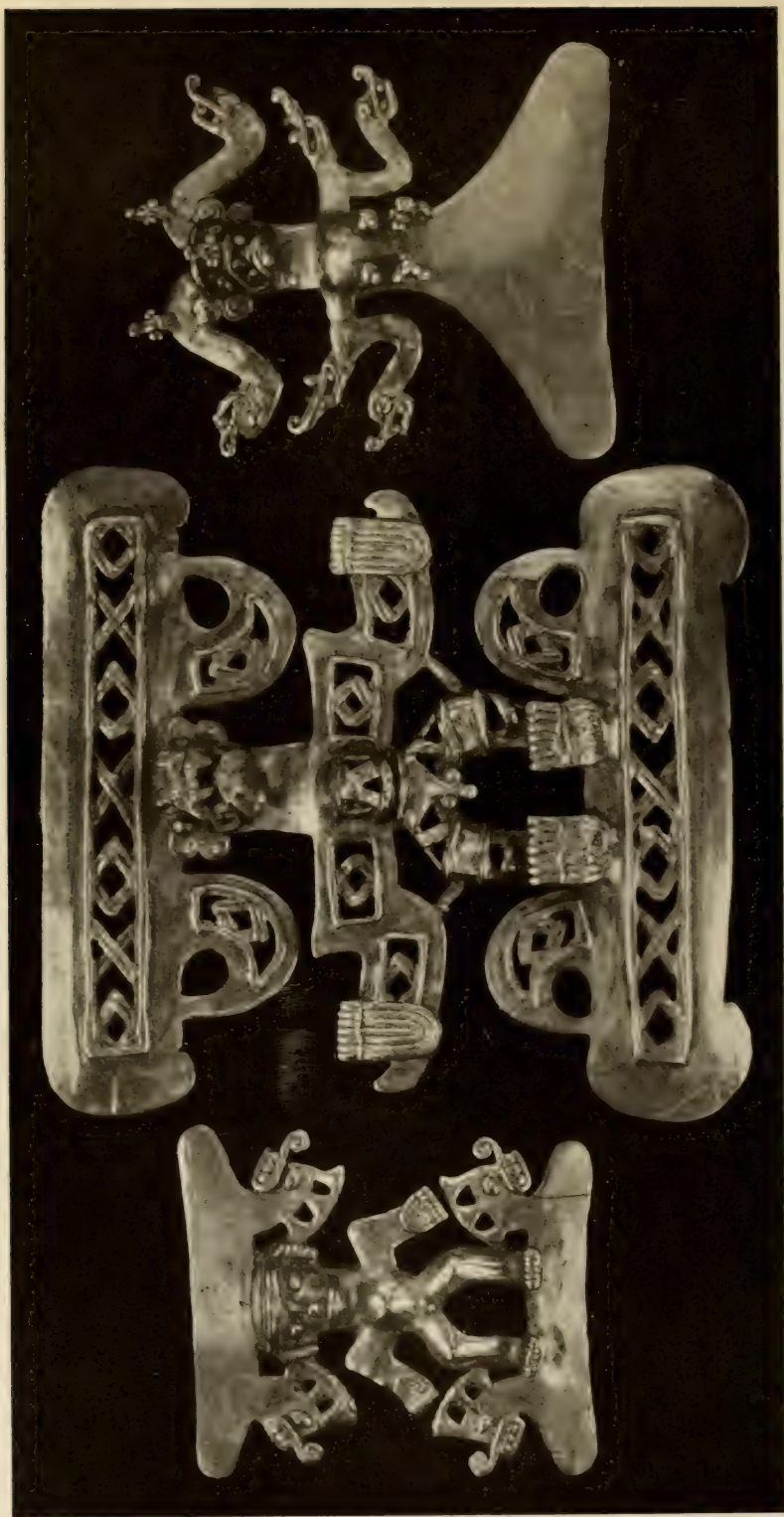
In the table cases on this side of the hall are facsimile reproductions of native books or codices, which were painted free hand on strips of deerskin, paper, or cloth. Several original documents are also exhibited. The Spaniards, in their zeal to destroy the native religion, burned hundreds of these books, which recorded ceremonial rites and historical event by means of pictures and hieroglyphs.

Nearby is a replica of the Calendar Stone, which is a graphic representation of the four creations and destructions of the world, as well as a symbol of the sun and a record of the divisions of the year.

In the aisle near the end of the hall stands a copy of the great sacrificial stone, or Stone of Tizoc, on which is a record of the principal conquests made before 1487.

The statue of Coatlicue, the mother of the two principal Aztec gods, is a curious figure, made up of serpents.

These three sculptures were originally in the Great Temple enclosure at Tenochtitlan, the native name of Mexico City before its conquest by Cortez, but they have been removed to the Mexican National Museum.



ANCIENT GOLD OBJECTS FROM COSTA RICA
In the Minor C. Keith Collection

The Nahua culture of Mexico extended through many centuries, relics of which are found deposited in distinct layers, one above the other. In the valley of Mexico there are three so-called culture horizons, the last being that of the Aztecs. These three stages of culture are represented on the north side of the hall beginning at the western end. We first have the Archaic Period as represented in the culture of Tarasca and Jalisco. Here are many crude figurines of pottery. The eyes and other features are formed by adding fillets of clay which are afterwards rudely modeled.

Next in order is the culture of the Toltecs, who were skilled in making pottery, the decorations of which were frequently stamped on with terra cotta stamps. Examples of this work together with the stamps are shown in one of the cases.

Near the middle of the hall the final period, that of the Aztecs, is shown representing their work in clay and stone.

Near the east end of the same side of the hall in the same order will be found the Archaic Period of Central America, and the succeeding Maya civilization as represented at Chichen Itza and Copan.

The Maya were perhaps the most highly civilized people in the New World. They built many cities of stone and erected many fine pillar-like stelae to which attention was called on entering the hall. The sculptures on these monuments represent priest-like beings who carry serpents and other ceremonial objects in their hands. There are also on them long hieroglyphic inscriptions containing dates in the wonderful Maya calendar. Maya history contains two brilliant periods. That of the south, extending from 160 A. D. to 600 A. D., was chiefly remarkable for its sculptures. The principal cities were Copan, Quirigua, Tikal, Yaxchilan, and Palenque. The second period fell between 950 A. D. and 1250 A. D., and centered in northern Yucatan. The chief cities were Chichen Itza, Uxmal and Labna, and the finest works of art were architectural.

SOUTHWEST PAVILION

PREHISTORIC MAN OF NORTH AMERICA

Continuing west we pass into the *Southwest Pavilion*, likewise given over to archaeology, in this instance that of North America. Here are examples of ancient pottery, arrow-heads, stone axes and other implements of stone and bone, mostly from burial mounds. The most important of these are the rude implements and fragments of human bones from the Trenton gravels, as these are the most probable evidences of man's antiquity on this continent. Notice that the arrangement

of the hall is geographical and by states. In addition there is a special exhibit of Mississippi Valley pottery in the wall cases and the Douglass type specimen series in the cases to the left.

In the adjoining tower room are the implements and carvings made by the early inhabitants of western Europe. These are arranged in an evolutionary series, beginning with the so-called eoliths in the first case on the left, and continuing through the various stages of the paleolithic period to the neoliths of more modern times. This series, showing the gradually improving skill and artistic taste of primitive man, represents at least two hundred and fifty thousand years of man's early history, during which time Europe passed through alternating warm and frigid conditions as the great glacial ice cap crept down from the north and receded. This changing climate was accompanied by corresponding changes in the animals associated with man and on which he largely lived. Some of these are represented by the paintings on the walls copied from the caves of northern Spain and southern France where, soon after the final retreat of the great glacier, man left us illustrations in color of the bison, mammoth, reindeer and horse of that day.

**Prehistoric
Man in
Europe**



PREHISTORIC STONE IMPLEMENTS



WEST WING

COLLECTIONS FROM AFRICA

Opening to the north from this hall of North American Archæology is the *African Hall*. This differs from other halls in containing besides ethnographical specimens a number of characteristic African mammals. The future extension of the Museum will provide room for groups of African mammals, including elephants. The installation is geographical, i. e., as the visitor proceeds through the hall from south to north he meets the tribes that would be found in passing from south to north of Africa, and the west coast is represented along the west wall, the east coast along the east wall.

There are three aboriginal races in Africa: the Bushmen, the Hottentot, and the Negroes. In the north the Negroes have been greatly influenced by Hamitic and Semitic immigrants and become mixed with them.

At the south end of the Hall the wall is decorated with reproductions of cave-paintings made by the Bushmen, the most ancient and primitive of African natives. These works of art are remarkable for their realism, and should be compared with the reproductions of old European cave-paintings in the tower of the adjoining hall.

Nothing is more characteristic of the Negro culture, to which the rest of the Hall is devoted, than the art of smelting iron and fashioning iron tools. The process used by the African blacksmith is illustrated in a group near the entrance, on the west side, and the finished products, such as knives, axes, and spears, are amply shown throughout the hall. The knowledge of the iron technique distinguishes the Negro culturally from the American Indian, the Oceanian, and the Australian.

All the Negroes cultivate the soil, the women doing the actual tilling while the men are hunters and, among pastoral tribes, herders. Clothing is either of skin, bark cloth, or loom-woven plant fiber. The manu-

facture of a skin cloak is illustrated by one of the figures in the group to the left of the entrance; bark cloths from Uganda are shown in the northeastern section of the Hall; while looms and the completed garments are shown in the large central rectangle devoted to Congo ethnology. The most beautiful of the last-mentioned products are the "pile cloths" of the Bakuba, woven by the men and supplied with decorative patterns by the women. Very fine wooden goblets and other carvings bear witness to the high artistic sense of the African natives, who also excel other primitive races in their love of music, which is shown by the variety of their musical instruments.

A unique art is illustrated in the Benin case in the northern section of the Hall, where the visitor will see bronze and brass castings made by a process similar to that used in Europe in the Renaissance period. It is doubtful to what extent the art may be considered native.

The religious beliefs of the natives are illustrated by numerous fetiches and charms, believed to give security in battle or to avert evils. Ceremonial masks are shown, which were worn by the native medicine-men.

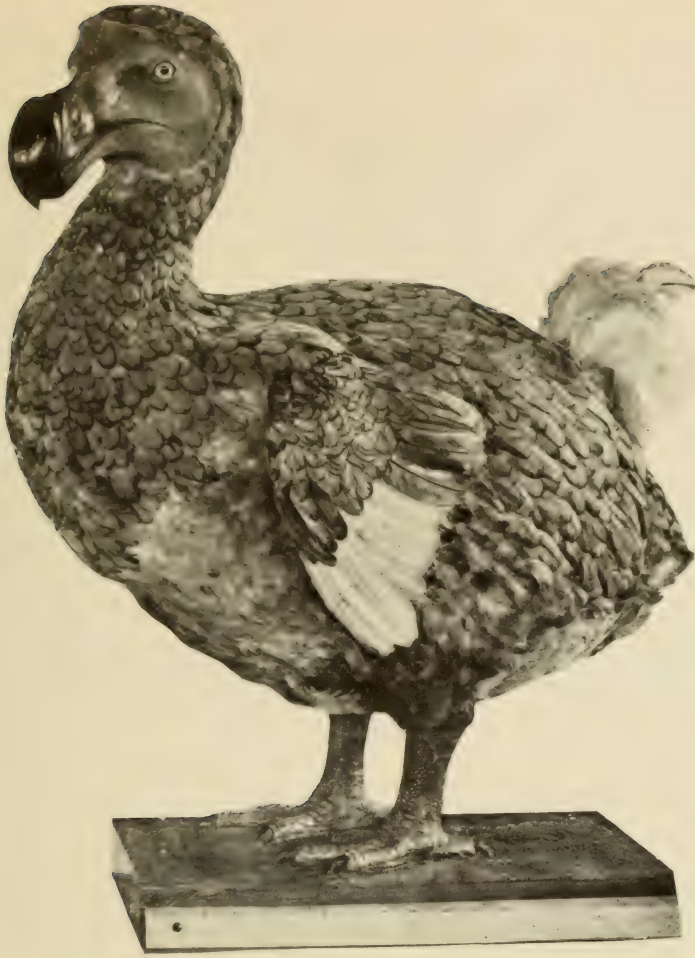
[Return to Central Pavilion].

SOUTH CENTRAL WING

BIRDS OF THE WORLD

Going north we enter the hall containing the general collection of birds. In the first four main cases on the right the 13,000 known species are represented by typical examples of the principal groups arranged according to what is believed to be their natural relationships. The series begins with the Ostriches, the "lowest" birds (that is, those which seem to have changed least from their reptilian ancestors), and goes up to those which show the highest type of development, the Singing Perching Birds such as our Thrushes and Finches. The remaining cases on the right wall and all of those on the left show the geographical distribution of the bird fauna of the world. The specimens are grouped according to their great faunal regions, the South American Temperate, American Tropical, North American Temperate, Arctic Eurasian, Indo-Malay, African and Australian realms. These cases in connection with the accompanying maps give opportunity for a comparative study of the birds of the different parts of the world. In each region, as in the Synoptic Collection, the birds are arranged in their natural groups to the best of our present knowledge.

Birds of
the World



THE DODO

Restored from Old Dutch Paintings.

Down the middle of the hall near the entrance are several cases containing birds which have become extinct or nearly so. The **Extinct Birds** Labrador Duck, once a common visitor to our Long Island shores, became extinct for no known reason. The Great Auk and the Dodo were flightless species which bred in great numbers on small islands and were easily and quickly killed off by men. The Passenger Pigeon of North America lived by the million in such dense flocks that vast numbers were slaughtered with ease, but the last individual died in captivity Sept. 1, 1914. The Heath Hen formerly had a good range on our Atlantic seaboard, but as a game bird it was so continually persecuted, in and out of the breeding season, that it is



THE PTARMIGAN IN WINTER

One of a series of four small groups showing this bird's seasonal changes of color as brought about by molting and feather growth.

now extinct except for a few which survive under protection on the island of Martha's Vineyard. Specimens of all of these birds are shown here, the Dodo being represented by an incomplete skeleton and by a life-size reproduction copied from an old Dutch painting. Others of our splendid game birds, such as the Trumpeter Swan and Eskimo Curlew, are nearly, if not quite, gone and more, like the Wood Duck and Wild Turkey, will soon follow them if a reasonable close season and limited bag be not rigidly enforced. Still others—the beautiful Egrets and the Grebes, for example—have already gone far on the same road owing to the great demand for their plumage for millinery purposes.

Also down the center of the hall are several cases designed to illustrate the general natural history of birds.

The widely different plumages (varying with age, sex, season, or all three) often worn by one species will be found illustrated in the Ptarmigan case and in the case containing Orchard Orioles, Snow Buntings, Scarlet Tanagers and Bobolinks. The relationship between structure and habits, the many forms of bill, feet,

General Topics



LABRADOR DUCKS, NOW EXTINCT

From the Group in the American Museum.

wings, tail, etc., and the different ways of using them are illustrated in other cases, particularly by one showing the feeding habits of some birds.

In the alcoves to the right the first egg case contains the Synoptic Collection of Eggs which shows the variation in the number in a set, size, shell texture, markings, shape, etc., and tells something of the laws governing these things. The succeeding cases contain the general exhibition collection of nests and eggs, principally those of North American and of European birds.

Near the center of the hall is a nearly complete collection of the Birds of Paradise, presented by Mrs. Frank K. Sturgis. This family of birds is confined to New Guinea, Australia and some neighboring islands. Their feet and bills show their close relationship to the Crows and Jays, which they resemble in nesting habits as well. Their chief characteristic is of course their gorgeous plumes, wonderful as well in variety of form and position as in beauty. For these plumes the birds are still being killed in such large numbers that unless the demand for them soon ceases all the finer species will be exterminated, as the Great Bird of Paradise is already believed to be. More Birds of Paradise have been sold at a single London auction (23,000 in two sales) than are contained in all the museums of the world.

In this hall, too, are a number of groups of local and other birds which are placed here only temporarily. In fact, much of the arrangement of the hall will be changed as soon as circumstances permit.

Suspended from the ceiling is the skeleton of a Finback Whale, sixty-two feet in length

Finback Whale



THE BOWFIN GROUP

To illustrate the nesting habits of the bowfin or mudfish (*Amia calva*). At the left the male and female fishes are seen over a nest; at the right a male is standing guard over the eggs. The materials for the group were collected at Fowler Lake, Oconomowoc, Wisconsin, in May, 1912.

CORRIDOR OF CENTRAL PAVILION

RECENT FISHES

The exhibit of fishes occupies the center of the north end of the hall of the birds of the world and the corridor beyond the door leading to the gallery of the *Auditorium*.

The exhibit includes typical examples of the various groups of back-boned animals popularly comprised in the term "fishes," and is arranged in progressive order. The visitor should first examine the case of hag-fishes and lampreys facing the large window, near the end of the corridor. These rank among the most primitive "fishes." They are with-



A PORTION OF THE PADDLEFISH GROUP

out scales, without true teeth, without paired limbs, and their backbone consists of but a rod of cartilage. One of the models shows the way in which a newly caught hag-fish secretes slime, forming around it a great mass of jelly. In the same case are lampreys, and one of them is represented attached to a fish, which it fatally wounds. The nest-building habit of lampreys is illustrated in a neighboring floor case: here the spawners are preparing a pit-like nest and carrying away stones, which they seize with their sucker-like mouths.

The visitor should next inspect the cases of sharks which are situated on the south side of the corridor. These include various forms of sharks and rays, selected as typical members of this ancient group—for the sharks have numerous characters which put them in the ancestral line of all the other groups of fishes.

Hag-fishes
and
Lampreys

Sharks



LUMINOUS DEEP-SEA FISHES

At the top as seen in daylight; below as they would appear in the deep sea by their own phosphorescence.

Next to be visited are the silver sharks of *Chimaeroids*, which are exhibited by the side of the lamprey case. They are now known to be highly modified sharks: their scales have failed to develop, and their heavy "teeth" appear to represent many teeth fused together. These fishes are now very rare and, with few exceptions, occur in the deep sea. The present models show the characteristic forms.

The adjacent case pictures the three types of surviving lungfishes, and the models are arranged to indicate the life habits of these interest-

Lungfish ing forms. Thus they are shown going to the surface of the water to breathe; and their poses indicate that they use their paired fins just as a salamander uses its arms and legs. In fact, there is reason to believe that the land-living vertebrates are descended from forms closely related to lungfishes. One sees in this case also a "cocoon", in which the African lungfish passes the months when the streams are dried up and during which time it breathes only by its lungs.

Returning again to the cases of sharks, one sees on a panel above them two huge sturgeons and two large gar pikes. These are examples of the group known as Ganoids,—fishes that represent, as it were, a halfway station between lungfishes and sharks on the one hand, and the great tribe of bony fishes on the other—such as perches, basses, cod, etc. A further glimpse of the Ganoids may now be had by viewing the spoonbill sturgeon (paddlefish) group, on the side opposite. In this group a number of these eccentric fishes are shown side by side with gar-pikes and other characteristic forms from the Lower Mississippi. This group was secured through the Dodge Fund. In the window are groups showing the shovel-nosed sturgeon, and the spawning habits of the bowfin and of the slender-nosed garpike,—all Ganoids.

Passing now through the door leading to the Bird Hall, we are confronted by a case containing additional examples of the Ganoids. Here one sees garpikes, sturgeons, the mudfish (*Amia*), together with the African Bichir, a curious Ganoid encased in bony scales and retaining structures which bring it close to the ancestral sharks.

The remaining cases in the center of the bird hall give characteristic examples of the various groups of modern "bony fishes," or Teleosts. There are fourteen cases of them in all, but they offer little space in which to illustrate the 10,500 species. For these are the fishes which are dominant in the present age, contributing over nine-tenths of all existing forms and including nearly all food and game fishes such as bass, cod, eel and herring.

The cases should be examined in the order in which they are arranged:

and one may pass in review the catfishes, carps, eels, trout, salmon, pike, mullets, mackerel, basses, wrasses, drumfish, sculpins, cods, flatfishes and anglers.

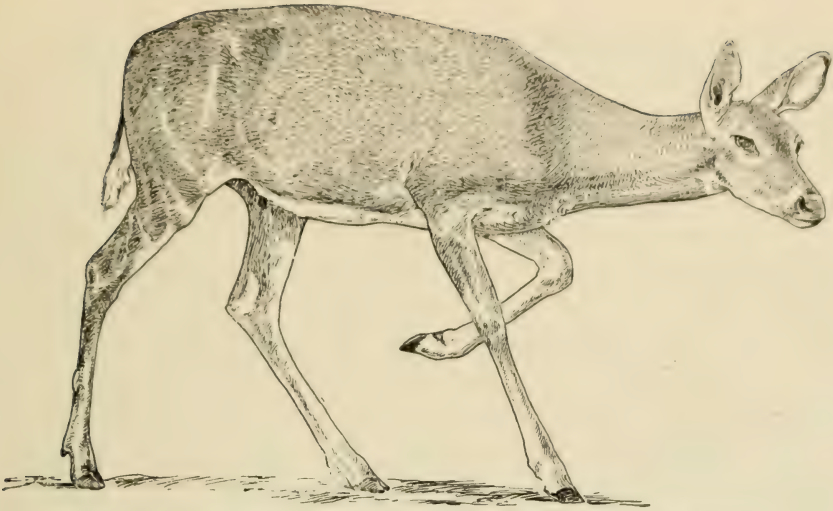
The end case exhibits the grotesque fishes from deep water, in which they occur to the surprising depth of over 3,000 fathoms, or more than $3\frac{1}{2}$ miles. They are usually soft in substance, with huge heads and dwarfish bodies, and are often provided with illuminating organs like little electric bulbs, which can be "shunted" off or on by the fish, and enable the fishes either to see their neighbors or to attract their prey. A group representing a number of these fishes as they are supposed to appear in the gloom of the profound depths, lit up only by their luminous organs, is shown in an enclosure next to the Paddlefish Group mentioned above.

Before the visitor has completed his review of the hall, he should examine the two wall cases, on either side of the doorway, which explain the characteristic structures of fishes of different groups, and the way in which the groups are related to one another. In one of these wall cases various kinds of fishes have been arranged in a genealogical tree, and the lines and labels give an idea of their evolution.

[Return to the Elevators.]



CHIMÆRA, A DEEP SEA "SHARK"



THE VIRGINIA DEER—A CHARACTERISTIC NORTH AMERICAN MAMMAL

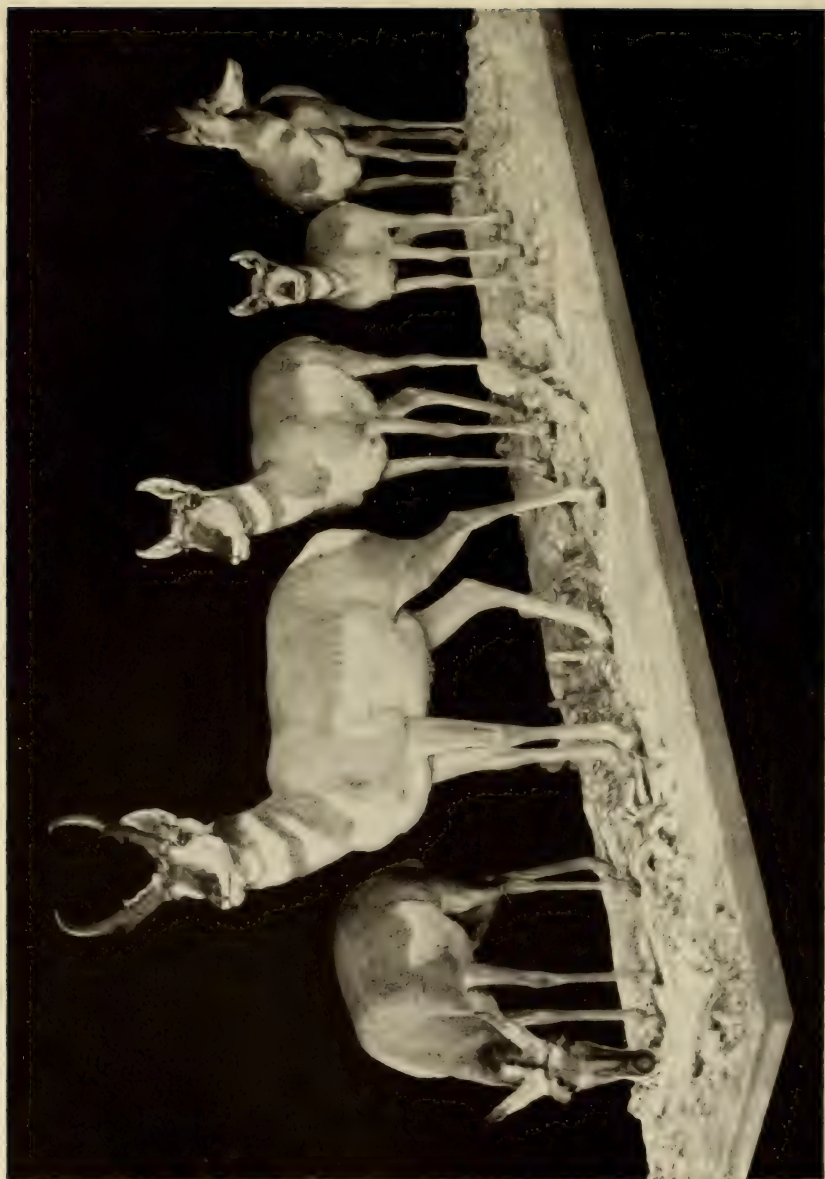
Line drawing from the mounted specimen. This Virginia doe stands as the first example in the Museum of the new methods of animal sculpture as opposed to the old taxidermy. It was mounted and presented by Carl E. Akeley in 1902.

SOUTHEAST WING

MAMMALS OF NORTH AMERICA

Continuing east beyond the elevator corridor, we enter the hall devoted to North American mammals, the first to catch the eye being the giant moose of Alaska. In the cases on the west wall and elsewhere are groups illustrating species found within fifty miles of New York City. One of these groups shows the opossum, the sole representative in the United States of the marsupial or pouched mammals. With what appear to be the head and ears of a pig and the prehensile tail of a monkey, with a strange pouch for the transportation of the young, and with proverbial cunning and remarkable tenacity of life, the opossum is one of the quaintest and most interesting of North American mammals. This is the animal so famous in the negro songs of the South.

Next is the raccoon, more commonly known as the "coon." It is nocturnal in habit and makes its nest in hollow trees. Two species of fox are shown, the red fox and the gray fox, both of which are justly famous for their sly cunning.



A GROUP OF PRONGHORN ANTELOPE, SHOWING THE MANNER IN WHICH THEY WANDER ACROSS THE PLAINS
This animal is peculiar to North America and is the only hollow-horned ruminant in which the horn sheaths are shed yearly.

The common skunk is a very useful although greatly abused animal.

Skunk While it occasionally destroys poultry and other birds, its principal food consists of injurious insects and field mice. Its defensive weapon is an excessively fetid fluid secreted by a pair of glands situated near the base of the tail. It has the ability to eject this



THE WEASEL GROUP

One of the groups representing the small mammals found within fifty miles of New York City. The others of the series show opossum, raccoon, red and gray foxes, skunk, mink, muskrat, woodchuck, rabbits and squirrels. The list includes some "fur-bearing" species; weasel fur is often used instead of ermine.

fluid to a considerable distance. Its skin makes a valuable fur known as "Alaskan sable."

Mink and Weasel Two other fur-bearing animals shown are the mink and the weasel, the latter in both its summer dress of dull brown and its winter coat of white. Weasel fur is often used in place of ermine.

Muskrat Another fur-bearing animal shown is the muskrat. In the group are seen its summer home, usually a burrow in the bank of a stream or pond, and its winter mound, constructed of

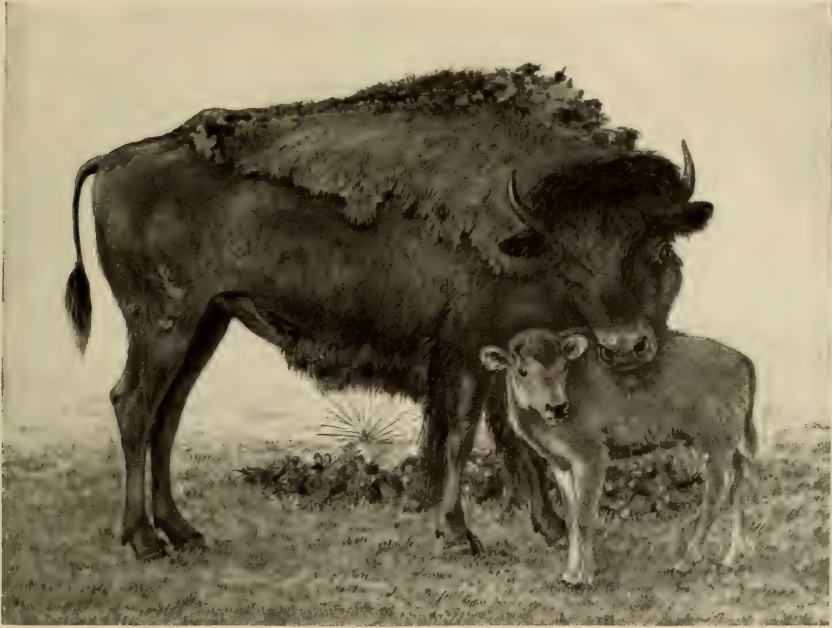


FUR SEALS ON KITOVÍ ROOKERY, PRIBILOF ISLANDS

swamp grass and roots mixed with mud. Muskrats are extensively trapped for their fur and in 1913 no less than 4,500,000 were sold in London.

Brown Bat

A group of little brown bats shows about a hundred of these animals gathering in Wyandotte Cave, Indiana, for their long winter sleep.



BISON COW AND CALF

The big game of North America is described in Guide Leaflet No. 5, North American Ruminants.

The woodchuck or ground hog is a vegetable feeder, but does very little harm to crops save clover. It hibernates for a large part of the year, usually from September to April. The old legend says that the ground hog comes out of his hole on the second of February, and if it is bright and he sees his shadow he goes back into his hole for six weeks longer and we may expect more cold weather. Other groups represent the varying hare and the common species of squirrels.

Woodchuck

**Hares and
Squirrels**

In the central section of the hall is a group of moose. It represents an early autumn scene in a second-growth forest in New Brunswick, and illustrates one of the favorite feeding grounds of the moose.

Moose Group



THE AMERICAN BEAVER

This shows the work and home life of the beaver. The old beavers are cutting trees for food and for building dams and houses. In the foreground a house with part torn away to show the little beavers within

The buffalo group gives a typical bit of the prairie traversed by buffalo trails while the members of the herd represent different stages of growth of the buffalo. This is the animal which formerly roamed in countless numbers over the Western plains, but which is now reduced to a few insignificant herds.

In the center of the hall, too, is a group showing the color phases of our black bear, from which it appears that in a part of its range the black bear is literally a white bear.

Alaskan Brown Bear, Fur Seals On the north side of the hall is a pair of the huge brown bears of Alaska, a family of fur seals from the Pribilof Islands and a family of Rocky Mountain goats.

At the end of the hall is a group of Roosevelt elk found in the Coast Range from British Columbia to northern California. Once abundant, they have become much reduced in numbers, though an effort is now being made to preserve them. On the opposite side of the hall are the Mountain Sheep or bighorns.

Near by is a group of that interesting animal, the beaver, perhaps the most important of North American mammals and one intimately connected with the early history and exploration of this country.

On the south side of the hall are displayed the cloven-hoofed animals of North America. These include sheep, musk ox, caribou, collared peccary and various species of deer. In one of the cases is a group of antelope showing the manner in which they wander across the plains.

Here too are, for the time being, shown the mammals of the polar regions, placed in the North American hall in order that the *Southeast Pavilion*, which once harbored them, may be used as a workroom for the preparation of a group of African elephants and other mammals from the dark continent.

Grant's Caribou Group Grant's caribou inhabits the barren ground of the extreme western end of the Alaskan peninsula. The type specimen of this series is in the Museum.

Near by is a group of the Atlantic walrus. These huge mammals are relatives of the seals, inhabit the waters of the Far North and are still fairly abundant along the shores of Greenland. The seal and walrus are the animals which play such an important part in the life of the Eskimo. From these animals come the principal food supply, skins for clothing, for fishing and hunting gear, boat covers, and harnesses for dog teams; from bones and tusks are made knives, bows, harpoons, and other hunting and cooking utensils.

The specimens in the musk ox group were collected for the Museum by Admiral Peary in 1896. Musk oxen inhabit the snow-covered wastes of the Arctic barrens, living mainly upon willow leaves, dug up from under the snow.

Note the various devices in the way of labels introduced to make the exhibits interesting and instructive. At the entrance attention is called to the principal causes influencing the distribution of mammals; on many of the labels are maps showing the range of the species shown, and near the group of mountain sheep is a label including a map and miniature models illustrating the species of North American mountain sheep and their range.

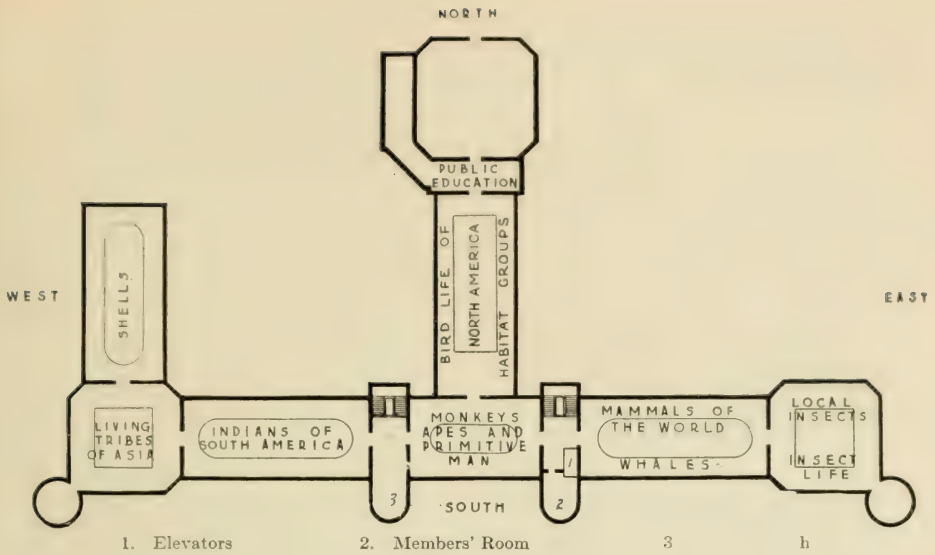
SOUTHEAST PAVILION

Being used as a workroom; see paragraph on preceding page.

Owing to the lack of an appropriation, no additions have been made to the Museum building for the past ten years, and although a new wing was authorized and the excavation for the basement actually made, work was stopped in 1912.

Owing to this fact, and the continued work of the Museum expeditions, all space in the Museum, and especially the storage rooms and work rooms, have become badly congested. When Mr. Akeley began the preparation of the group of African Elephants, intended as the central piece for the projected African Hall, it was necessary to clear out the Southeast Pavilion in order to provide necessary space: when the collections were received from the Congo Expedition, the collection of fishes was removed from the Central Corridor to the Bird Hall to furnish a little storage room. The beautiful Reptile Groups are installed in temporary quarters in the Central Pavilion, Second Floor, while nothing can be done toward exhibiting the collection of Mammals of the Sea, and the African Hall—the most beautiful and comprehensive museum exhibit yet devised—is still in the future.

[*Return to the Elevators.*]



THIRD FLOOR EAST CORRIDOR

Members' Room

To the left of the elevators is a room set apart for the use of honorary or subscribing members of the Museum, where they may leave their wraps, rest, write letters, or meet their friends. Near by is a bronze tablet in memory of Jonathan Thorne, whose bequest provides for lectures and objects for the instruction of the blind.

SOUTH PAVILION

MONKEYS, APES, RODENTS, BATS

This is one of the halls in course of rearrangement and, in the final plan, is intended to include primitive man as well as the other members of the order Primates.

The family of orang-utans, on the south side, was one of the first groups of large animals to be mounted in this country, and was considered a daring innovation. Near by are examples of the gorilla, the largest and most powerful of the great apes, and the chimpanzee, which is the most like man in proportions and structure. "Mr. Crowley," one of the few full-grown apes that have endured captivity, lived for some time in the Central Park Zoo. Skeletons of man and the large apes illustrate the similarities and difference in structures between them, and these are supplemented by figures of some of the many races of man.



PHILIPPINE FRUIT BATS
Bats by Walter Eschrich. Accessories by A. E. Butler



DUCK HAWK ON PALISADES OF THE HUDSON

Realism and artistic effect have been achieved in the "Habitat Bird Groups," and they present vividly many stories of adaptation to environment.

The bats, the only mammals that really fly, and rodents, the most numerous and widely distributed of mammals, are provisionally placed in this hall pending other arrangements.

The fruit bats, often known as flying foxes, the largest members of the order and found only in the warmer parts of the Old World, are represented by a small portion of a colony from Calapan, Philippine Islands. Such a colony may number several thousands, and be very destructive to bananas and other fruits.

Suspended from the ceiling in the center of the hall is the skeleton of a medium-sized North Atlantic right whale, a species once common on our coast, but now all but exterminated in the North Atlantic.

SOUTH CENTRAL WING

BIRD GROUPS

Here are the "Habitat Groups" of North American birds. This unique series of groups shows the habits of some typical American birds in their natural haunts. The groups have been prepared under the immediate direction of Frank M. Chapman, curator of ornithology, who



THE ORIZABA GROUP

The observer is looking across the valley of the Rio Blanca, over the tropical forest, to Mount Orizaba

collected most of the specimens and made practically all of the field studies necessary for their reproduction. In the course of this collecting, he traveled more than 60,000 miles. The backgrounds are reproductions of specific localities, painted from sketches made by the artist who usually accompanied the naturalists when the field studies for the groups were made. Practically all sections of the country are represented, thus the series not only depicts characteristic bird life of North America, but characteristic American scenery as well. The backgrounds of the groups were painted by Bruce Horsfall, Charles J. Hittell, J. Hobart Nichols, Carl Rungius, W. B. Cox and Louis A. Fuertes. The foliage and flowers were reproduced in the Museum laboratories from material collected in the localities represented. Each group is fully described in the label attached to the case. [See *Guide Leaflet* No. 28.] Beginning with the case at the right of the entrance and passing on to the right around the hall, we find the groups arranged in the following sequence:

The distribution of birds, notwithstanding their powers of flight, is limited in great measure by climate. Thus in traveling from Panama north to Greenland there are zones of bird life corresponding to the zones of temperature. This condition is illustrated in the mountain of Orizaba in Mexico, where in traveling from the tropical jungle at its base to its snow-clad peak the naturalist finds zones of life comparable with those to be found in traveling north on the continent. Thus the Orizaba group so far as the distribution of life is concerned is an epitome of all the groups in the hall.

Among our most beautiful and graceful shore birds are the terns and gulls, which (because of their plumage) have been so ceaselessly hunted and slaughtered for millinery purposes that now in their breeding-places there are only hundreds where formerly there were thousands. The group represents a section of an island off the Virginia coast where the birds are now protected by law.

The duck hawk may be found nesting on the Palisades of the Hudson almost within the limits of New York City. It builds nests on the ledges of the towering cliffs. This hawk is a near relative of the falcon which was so much used for hunting in the Middle Ages.

In August and September the meadows and marshlands in the vicinity of Hackensack, New Jersey, are teeming with bird life. In the group showing these Hackensack meadows are swallows preparing to migrate southward, bobolinks or rice birds in fall plumage, red-winged blackbirds, rails and the wood duck.

The wild turkey is a native of America and was once abundant in the wooded regions of the eastern portion of the United States, but is

now very rare. It differs in color from the Mexican bird, the ancestor of our common barnyard turkey, which was introduced from Mexico in Europe about 1530 and was brought by the colonists to America. (Reproduced from studies near Slaty Forks, West Virginia.)



A PORTION OF THE EGRET GROUP

As shown here, the birds carry their plumes only during the nesting season; killing the parents means the slow starvation of the young.

its neck well out when on the wing. (Reproduced from studies on the Kissimmee Prairies of Florida.)

Pelican Island on the Indian River of Florida has been made a

The great blue heron usually nests in trees. The Florida Great Blue Heron bird flies with its neck curved back on its body and because of this habit can readily be distinguished from the crane with which it is frequently confounded. (Reproduced from studies near St. Lucie, Florida.)

In the "bonnets" or yellow pond-lily swamps with "Snake-bird" cypresses and cabbage palmettoes, the shy water turkey builds its nest. It receives the name "turkey" from its turkey-like tail and the title "snake-bird" from its habit of swimming with only the long slender neck above water. (Reproduced from studies near St. Lucie, Florida.)

The sandhill crane builds its nest of reeds in the water. Sandhill Crane Group

Unlike the herons in this respect, it differs also in its manner of flight, always stretching

reservation by the United States Government and these grotesque birds may now breed there undisturbed. The view shows a section of the island at the height of the nesting season. Notwithstanding the hundreds of young birds that are clamoring for food, observation has shown that the parent bird can pick out its own offspring with unfailing accuracy. (Reproduced from studies at Pelican Island, Florida.)

This beautiful bird has been brought to the verge of extinction in this country through the use of its "aigrette plumes" for millinery purposes, and is now confined to a few protected rookeries of the South. The birds have these plumes only during the nesting season, at which time the death of the parent means the starvation of the young. (Reproduced from studies in a rookery of South Carolina.)

The turkey vulture, or buzzard, is one of the best known birds of the South, where it performs a valuable service in acting as the scavenger of the streets. On this account it is protected by law and by public sentiment and has become both abundant and tame. (Reproduced from studies at Plummer Island in the Potomac River, near Washington.)

The California condor is the largest and one of the rarest of North American birds. It is not so heavy as the condor of the Andes, but has a slightly greater spread of wing, eight and one-half to eleven feet. In the group the visitor is supposed to be standing in the interior of the cave where the bird has its nest and is looking down on the river of the cañon which is more than five thousand feet below. (Reproduced from studies in Piru Cañon California.)

The foreground of the group shows a detail of the island that is painted in the background. The young birds are feeding, and it will be noticed that one fledgling is reaching well down the mother's throat after the predigested food. (Reproduced from studies at Monterey, California.)

Formerly this area was an arid place with a characteristic desert bird fauna. Now the ranchmen have irrigated the land and aquatic bird-life abounds. This group is a good illustration of the influence of man on the bird-life of a region.

In the breeding season the flamingoes congregate in great numbers in their rookeries. There were estimated to be two thousand nests in this colony. The flamingoes construct their nests by scooping up mud with their bills and packing it down by means of bills and feet. The nests are raised to a height of



A FLAMINGO COLONY IN THE BAHAMAS

A "city" of these birds is the most remarkable sight in the world of birds. The mud nests are raised, from eight to fourteen inches, and thus protected during rise of water.

twelve or fourteen inches; this protects eggs and young from disasters due to high water. Only one egg is laid in the nest, and the young is born covered with down like a young duck and is fed by the mother on predigested food. The brilliant plumage of the adult is not acquired until the fifth or sixth moult. (Reproduced from studies in the Bahama Islands.)

**Booby and
Man-of-War
Bird Group** In this group is shown a portion of a coral islet on which three thousand boobies and four hundred man-of-war birds were nesting, the former on the ground, the latter in the sea grape bushes. (Reproduced from studies in the Bahama Islands.)

**Florida
Rookery
Group** The abundance of bird-life in one of these rookeries is quite astounding. In this group are roseate spoonbills, snowy egrets, American egrets, little blue herons, Louisiana herons, ibises, cormorants, and water turkeys. Because of the great inaccessibility of this island it has been one of the last places to escape the depredations of the plume-hunter. (Reproduced from studies in the Everglades of Florida.)

**Golden Eagle
Group** The golden eagle is one of the most widely distributed of birds. In North America it is now most common in the region from the Rockies to the Pacific Coast, although it is found as far east as Maine. Stories to the contrary notwithstanding, the eagle never attacks man, even though the nest is approached.

Its food consists of rabbits, squirrels, woodchucks, and occasionally sheep. (Reproduced from studies near Bates Hole, Wyoming.)

The abundance of bird life in this western lake beneath Mt. Shasta, which is seen in the center of the background, is astonishing.

**Whistling Swan
and
Whooping
Crane** These two groups have recently been added, though provision was made for them in the original plans for this gallery. The whooping crane was exterminated so rapidly that not only was it impossible to obtain a nest and young, but it was necessary to use old birds taken many years ago.

**Klamath Lake
Group** Here is an example of how the normal nesting habits of a bird may be changed by its being driven into a different locality. In the group are white pelicans which usually make a nest of pebbles, Caspian terns which commonly build their nests on sand, and cormorants that nest on rocks, all nesting together here on the tule or rush islets of the lake. (Reproduced from studies at Klamath Lake, Oregon.)

**Arctic-Alpine
Bird Life
Group** The scene represented in this group is above timber line on the crest of the Canadian Rockies, 8,000 feet above the sea. Although these mountains are in the temperate region, the altitude gives climatic conditions that would



Love making of the prairie chicken. In this position and with orange-like air sacs inflated, he produces a booming sound which may carry a distance of two miles.

be found in the Far North, and the bird life is arctic in character. Here are nesting the white-tailed ptarmigan, rosy snow finches and pipits. (Reproduced from studies in the Canadian Rockies.)

This group shows a stretch of Western plateau covered with sage bush. In this bush is seen the male sage grouse strutting and wooing a mate. (Reproduced from studies at Medicine Bow, Wyoming.)

The prairie chickens are akin to the common grouse. The group represents a typical scene during the mating season.

The male birds go through most surprising antics in their efforts to attract the females. They inflate the orange-colored sacs on the sides of their necks, dancing and strutting about and uttering a loud, resonant, booming note. (Reproduced from studies near Halsey, Nebraska.)

The wild goose is one of the first birds to migrate north in the spring. It nests in the lakes of Canada even before the ice is melted. To secure the young birds for this group it was necessary to hatch the eggs of the wild goose under a hen, so difficult is it to find the young in nature. (Reproduced from studies made at Crane Lake, Saskatchewan, Canada.)

The grebe is another of our aquatic birds which builds its nest near the water. During the incubation period the parent bird usually covers the eggs with grass and reeds when leaving the nest. Nesting at the same lake with the grebe was the redhead duck, which lays from fifteen to twenty eggs. (Reproduced from studies made at Crane Lake, Saskatchewan, Canada.)

The loon is justly famed for its skill as a diver, and can swim with great speed under water. Its weird call is a familiar sound on the northern New England lakes. Many loons pass the winter at sea fifty miles or more from

land. (Reproduced from studies at Lake Umbagog, New Hampshire.)

This rocky island thirty miles from shore in the Gulf of St. Lawrence affords some protection to the sea birds which still nest in great numbers on and in its cliffs, although the colony is a mere shadow of what it was even fifty years ago. Seven species are shown nesting in the group. Namely the razor-billed auk, petrel, gannet, puffin, kittiwake gull, common murre and Brun-nich's murre. (Reproduced from studies at Bird Rock, Gulf of St. Lawrence.) This was the first habitat group.

**Bird Rock
Group**

[Return to the South Pavilion containing the apes and monkeys.]

WEST CORRIDOR

PUBLIC HEALTH

Returning to the South Pavilion where the monkeys are, and passing to the right, we enter the *West Corridor* containing the exhibits of the Department of Public Health.

The Hall of Public Health is dominated by a bronze bust of Louis Pasteur, the founder of scientific bacteriology and preventive medicine, which was presented to the Museum through the courtesy of the Pasteur Institute of Paris. Near the head of the stairway is a reading table where pamphlets bearing on insect-borne disease and other public-health problems may be consulted.

The first section of the exhibit deals with the natural history of water supply as it affects the life and health of man. The large **Water Supply** frieze at the entrance to the corridor on the left illustrates the primary source of water supply, the sea, the clouds, and the secondary sources, rivers and lakes. Diagrams, models, and a relief map show the variations in rainfall at different points in the United States. Relief maps of the region about Clinton, Massachusetts, before and after the construction of the Wachusett Reservoir for the water supply of Boston, show the way in which surface water supplies are collected by impounding streams, and a model of a well sunk through impervious clay or rock down to water-bearing strata shows how ground-water supplies are obtained. A series of samples and models illustrate the variation in composition which occur in natural waters, from the swamps of Virginia to the deep wells of Iowa and the turbid rivers of the Ohio Valley.

Some of the principal micro-organisms, Algæ and Protozoa, which grow in reservoirs and impart tastes and odors to water are represented



THE HOUSEFLY OR TYPHOID FLY

Modeled 64,000 times the bulk of a fly. By Ignaz Matusch from his original studies.

by a series of glass models. The effect produced by the pollution of water by disease germs is illustrated by relief maps and diagrams showing the course of famous typhoid and cholera epidemics. Models are displayed which illustrates the purification of water by storage, filtration, and disinfection, the filter model being an elaborate representation of the plant at Little Falls, N. J. Diagrams indicate the results of water purification as measured in the saving of human life. Finally a series of five large relief maps show the growth and development of the water supply of New York City.

Following the water-supply exhibit is a series of models illustrating the dangers from improper disposal of the liquid wastes of the city and how they may be avoided. Actual points of danger in the neighborhood of New York are shown where polluted harbor waters, bathing-places, and shellfish beds constitute a menace to health. Modern methods for the treatment of sewage on scientific lines are illustrated by a series of models of screens, sedimentation tanks, and filter beds of various types.

The cases near the window are devoted to the group of Bacteria, especially in their relation to human life. Glass models show the various shapes and relative sizes of these minute forms, and in particular of the principal types which cause disease. In a nearby case are displayed actual colonies of a number of species of bacteria, including some which produce disease and others which are beneficial to man by their effect upon soil fertility or from the fact that they may be utilized in the production of substances useful as foods or in the arts. A group of transparencies at the window shows some of the more important disease bacteria as they appear under the microscope.

Another series of exhibits deals with the transmission of disease by insects, notably by the fly and flea and by the mosquito. The most striking features are greatly enlarged models of the fly, the flea, and the louse. These, the finest models of the kind ever made, were prepared by the late Ignaz Matusch from his original studies, and required several years of constant, exacting labor.

The egg, larva and pupa of the fly, and the eggs of the louse are also shown.

Models in the wall case deal with the life history of the fly, showing its various stages in their natural size and actual habitat, and illustrate the large numbers of flies which may breed in a single pound of manure and the enormous progeny which may spring from a single pair and their descendants during the breeding season.

The deadly work of the fly in carrying typhoid fever is illustrated by

graphic presentations of typhoid statistics of the Spanish-American War and of the relation between flies and "summer disease" of children, as worked out by the Association for Improving the Condition of the Poor in New York City.

Nearby are two models showing unsanitary and sanitary conditions on a small farm. In one, pools of stagnant water and uncovered manure heaps and general uncleanness favor the breeding of mosquitoes and flies, while the open doors and windows give these insects free access to the house. In the other, the swampy land is drained and cultivated, the windows screened, the shallow dug well replaced by a driven well; the conditions are sanitary, and health and prosperity replace sickness and poverty.

Various types of traps for larvæ and adult flies are shown with models illustrating how fly-breeding may be prevented, how human wastes may be protected from their access, and how manure may be cared for so as not to be a medium for breeding flies.

A wall case on the right of the entrance to the hall shows a group of the natural enemies of the fly: the cock, phebe, swifts, the bat, spiders and centipedes, in characteristic surroundings as they may be seen in the corner of a New York State farm on a late August afternoon.

The relation of the flea and the rat to the terrible disease bubonic plague is illustrated in considerable detail. Wall charts picture the spread of the great historic epidemics of this disease, and reproductions of sixteenth and seventeenth-century drawings show with what terror the Black Death was regarded in pre-scientific days. The chief carrier of the disease, the flea, is shown in a remarkable model, 120 times the length of the actual insect, and having the bulk of 1,728,000 fleas, prepared by Ignaz Matusch.

Specimens of some of the principal animals which harbor the plague germ and serve as reservoirs from which it is carried by the flea to man (the black, brown and roof rats, the wood rat and the California ground squirrel) are shown, and the manner in which the disease is disseminated is illustrated by a copy of a corner of a rat-infested house in California. The original from which this was copied, as well as many of the rats and squirrels, were obtained through the courtesy of the U.S. Public Health service of Washington. A habitat group shows a typical family of ground squirrels on a rocky hillside in central California, during the breeding season in May. Preventive measures used against the plague are illustrated by models of a farm with buildings rat-proofed, of a rat-killing squad, equipped for work in San Francisco, of a ship at dock with rat-guards to prevent the access of rats to the shore, and by specimens of various types of rat traps.

The Flea
and Bubonic
Plague

In a window case are shown various stages of the common mosquito, *Culex*, as well as of *Anopheles*, the carrier of malaria, and *Aedes*, which is responsible for the spread of yellow fever. In the same case are specimens of other insect carriers, such as the flea, the bedbug and the louse. Small cases flanking the windows contain specimens of the *Glossinas* which transmit sleeping-sickness and the Nagana disease in Africa, and of the ticks which spread Texas fever of cattle and relapsing fever, African fever, and Rocky Mountain spotted fever of man. Nearby are shown maps indicating the area affected by the principal tick fever in the United States and a model of a dipping vat used in freeing animals from tick infestation.

A series of models and diagrams is devoted to the life history of the *Anopheles* mosquito and its relation to malaria. A relief map of the State of Arkansas illustrates the coincidence between low swampy lands and the prevalence of malaria, and another shows the heavy incidence of malaria in the vicinity of marshlands near Boston. A small relief map indicates the type and arrangement of drains used for lowering the water level and eliminating mosquito-breeding pools, and diagrams illustrate the progress made in mosquito control in New Jersey and the financial return which has resulted.

A wall case devoted to the natural history of the mosquito illustrates the world distribution and seasonal prevalence of malaria and yellow fever in relation to the habits of their mosquito hosts, the breeding-places of mosquitoes, the life history (shown by specimens) and the money cost of malaria to the United States. Here are also shown some of the practical methods of control by ditching, oiling, stocking with fish, and encouraging enemies such as the bat, bite cures, and repellents and finally the practical results in the reduction of malaria which have been obtained in Italy.

A second mosquito case contains a series of small-scale models, attractively worked out by Otto Block, illustrating some of the methods and results of tropical sanitation as applied to the mosquito-borne diseases, malaria and yellow fever. A hospital at Panama is shown as it was during the French régime with mosquito-breeding pools all about and with the legs of the beds and the flower pots set in dishes of water to keep off the ants. In contrast there is illustrated a modern hospital with all stagnant water removed, and wards screened and ventilated. Other models show the sanitary squads on the Isthmus which fought the yellow-fever mosquito in the town by fumigation, and the malarial

mosquito in the country by ditching and oiling. The same case contains oil paintings of the completed canal and of the camp near Havana where the secret of the transmission of yellow fever was discovered and the foundations of tropical sanitation laid in 1900. Photographs of the four American Army officers, Reed, Carroll, Lazear, and Agramonte, to whose researches this advance is due, are hung upon the wall nearby.

One wall case is devoted to the subject of military hygiene, which has become of such immediate moment and has, **Military Hygiene** on the whole, been so successfully solved during the Great War. Diagrams illustrate the relative deadliness of disease germs and bullets in earlier wars; and their lesson is reinforced by a representation of the relative importance from injuries in action and from typhoid fever during the Spanish War. One company, confronted by a cannon, suffers the loss of one man wounded, while the other, facing a tube of typhoid germs, has one dead and thirteen in the hospital. Other models show how camp wastes are disposed of, and how water supply is sterilized, and still others, how the soldier's tent is protected against mosquitoes and how a field hospital is equipped. The field ration of the soldier and the preparation of anti-typhoid vaccine are illustrated by specimens and models.

Two tree trunks, one normal and the other infested with fungi as a result of mechanical injury, illustrate the important fact **Vital Resistance and Disease** the the normal plant or animal is able to resist disease, while anything which tends to lower vital resistance may open the way for the invasion of pathogenic germs.

The collection of Auduboniana, or objects relating to the life and **Auduboniana** works of John J. Audubon, presented to the Museum by his granddaughters, Maria R. and Florence Audubon, occupies the stairway hall. It includes original sketches and paintings by Audubon and his sons, illustrations in various stages from the Quadrupeds of North America, and some of the copper plates of the "Birds of North America." The most important piece is a large painting of a covey of "English" pheasants, flushed by a dog. Of more personal interest is the gun carried by Audubon on many of his expeditions and a favorite buckskin hunting coat.

SOUTHWEST WING

INDIANS OF SOUTH AMERICA

Passing through the west corridor, where the exhibit of the Department of Public Health is installed, and on into the adjoining hall to the west, we find the collections from South America. The greater part of the hall is filled with archæological material illustrating the various forms of culture existing in Colombia, Ecuador, Peru, Bolivia, and Chile in prehistoric times. The remains found in Peru, in parts of Central America, and in Mexico

Indians of
South
America



PIECES OF CLOTH FOUND WITH PERUVIAN MUMMIES

The prehistoric Peruvians were familiar with modern weaves, including the finest gobelins and produced highly decorative effects by harmonized colors and a repetition of woven-in designs. The Museum's collection of mummy cloths is one of the largest in the world, and is much used by teachers and students of art.

show a degree of culture far in advance of that attained in any other part of this continent in prehistoric times. Unlike the ancient peoples of Mexico and Central America the Peruvians had no written language. They were tillers of the soil and raised maize, potatoes, oca, quinoa, beans, coca, and cotton. The Incas domesticated the llama, which was used as a beast of burden. They excelled in the manufacture and decoration of pottery vessels, in metal work, and in textile fabrics. In the case



PERUVIAN MUMMY BUNDLES AND MUMMY

The ancient Peruvians wrapped their dead in fabrics of fine cotton and wool, then covering with a sack of strong cloth. The mummy "bundle" thus produced was often given a "false head" of cloth filled with cotton or vegetable fibre. Climatic conditions in Peru have preserved these mummies and their wrappings during many centuries.

directly in front of the entrance are displayed gold and silver objects, such as beads, cups, pins and ear ornaments, which show the high degree of skill attained in the beating, soldering and casting of metals. In weaving they were perhaps preeminent among prehistoric peoples, many of their specimens exhibited here being unsurpassed at the present day. The materials used were cotton and the wool of the llama, alpaca, and vicuna. In the first cases on the right are examples of these textiles with looms and shuttles. [The musical instruments of ancient Peru are discussed in *Guide Leaflet No. 11.*]

The alcove cases are geographically arranged, showing exhibits from the north toward the south of South America, then up into the interior of the continent. In the wall cases extending across the entire western end of the hall will be found a remarkable collection from Nazca, Peru. The prehistoric people of Nazca excelled as colorists, particularly in the decoration of their pottery vessels, which are certainly the most beautiful so far discovered in South America.

On the south side of the hall is shown a collection from Ica, Peru. In this exhibit are some rare and beautiful shawl-like garments of these prehistoric people, in a good state of preservation.

The special exhibits in the gallery rail cases include quipus used to keep



AN EXAMPLE OF NAZCA POTTERY



TREPHINED SKULLS FROM PREHISTORIC PERUVIAN GRAVES

accounts, charms and medicines, coca which was chewed with lime, and shells that were found in mummy bundles and in the graves. A number of the chicha jars are on exhibition on top of the cases.

In the first case to the left (south side) is a collection of skulls showing many examples of trephining, artificial deformation, and pathological conditions, together with a number of normal Peruvian skulls for comparison.

The wall case at the left of the entrance contains mummy bundles and various objects showing the burial customs of the Peruvians. In no part of America are found so many and so extensive burial places as in the coast region of Peru. Here were interred countless thousands of the ancient dead. In the *huacos* or graves, with the bodies, were placed such articles as had been most useful and highly prized during life, and such as it was considered would be most serviceable in a future life.

To this custom we are indebted for no small part of our knowledge of the daily life of the ancient Peruvians. From the mummy bundles and graves all the objects in the extensive collections in this hall, illustrating their civilization, have been obtained. The wonderful state of preservation shown in the textile fabrics and other perishable materials from the coast regions is due to the extreme dryness of the climate and the nitrous character of the soil. [See *Guide Leaflet* No. 24.]

The mummy in the case at the west end of the room was found in a copper mine at Chuquicamata, Chile. The body is that of and Indian miner who was killed by the falling in of rocks and earth while engaged in getting out the copper ore (atacamite) used by the Indians in making implements and ornaments in prehistoric times. The tissues of the body have been preserved by copper salts with which it is impregnated. The implements he was using at the time of his death are shown beside him in the case.

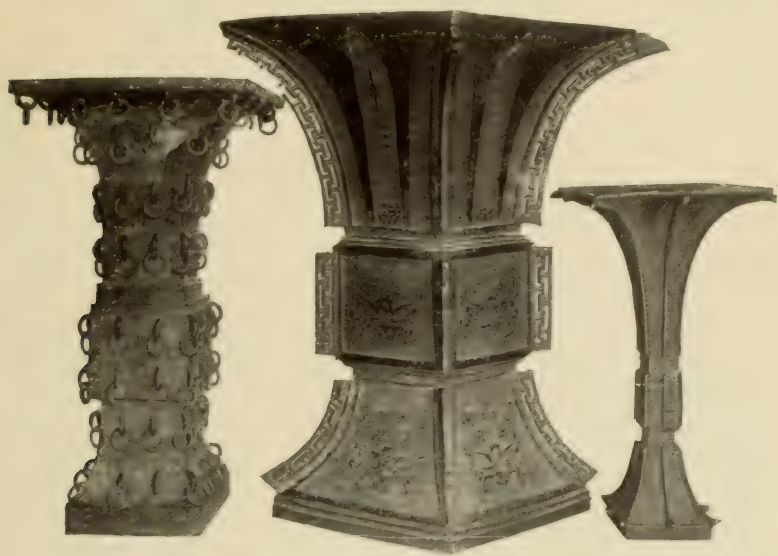
On the south side of the hall are the ethnological collections from Brazil, British Guiana, Paraguay and Colombia. War implements, basketry, featherwork, and musical instruments, etc., are arranged in these cases.

SOUTHWEST PAVILION

CHINESE AND SIBERIAN COLLECTIONS

If we pass on into the hall at the extreme west end of the building, we find collections from eastern and northern Asia. The arrangement is geographical. Specimens illustrating the culture, industries, religion, and manufactures of China are on the left; others showing the mode of living, the costumes, and the war implements of Siberia are on the right. The furwork, cos-

Collections
from Asia



ANCIENT CHINESE BRONZES

tumes, and rugs of the people of East Siberia reveal remarkable skill in workmanship. Two models show respectively summer and winter scenes in Siberia. A small model in one of the cases to the left shows the manner of making pottery. A series of frames in the rear contain pieces of various kinds of fabrics and patterns illustrating weaving and woodwork ornaments.

The collections deal mainly with the every-day life of the modern Chinese and have a special value, as they were made just before the sweeping changes of the last few years took place. These abolished many of the customs in which these objects were used; for example, the series of weapons and objects showing the tests to which a soldier was submitted on entering the army have been rendered obsolete



BLACK HELMET OR CAMEO SHELL

From the Morgan Collection

by the introduction of modern weapons and tactics. Bamboo, porcelain, basketry, inlaid work, cloisonne enamel, agricultural implements, carvings in wood, ivory, and stone, and embroidery are shown to advantage.

A special collection of great value is found in the ancient bronzes and pottery shown in the adjoining tower room.

WEST WING

SHELLS

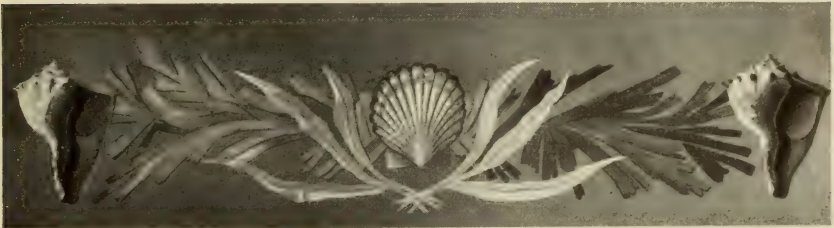
The collection of shells installed in the *West Wing* contains altogether about 100,000 specimens representative of nearly 15,000 species. These show extraordinary range of color and ornamentation. The arrangement of the collection is as follows: first, in the south wall cases a series showing briefly the classification of mollusks; second, in the eight table cases at the north and south ends of the hall the collections of land shells; third, in the upright railing cases the bivalves or mollusks which have two shells like the common clam; fourth, in the metallic cases the univalves, mollusks which have only one valve or shell like the snails; fifth, special exhibits of shells in the north wall cases. Other cases contain exhibits illustrating the anatomy and habits of mollusks; colored transparencies show them in their habitats.

Facing the entrance is a huge shell of the giant clam, *Tridacna*, measuring 43 by 27 inches and weighing 579 pounds, one of the largest examples on record.

Short descriptive group labels will be found in the cases, and on the walls, picture labels of important families of shells, together with small Maps of Distribution defining the occurrence of the same throughout the world.

An interesting collection of deformed shells is seen in the north case, and a series illustrating the ornamental uses of shells. Cases of especial beauty in their shell contents are those holding *Murex*, *Fusus*, *Volute*, *Conus*, *Oliva*, *Strombus*, *Cypraea*, *Nisira*.

[Return to the South Pavilion, containing the apes and monkeys.]



DECORATION FROM THE SHELL HALL

SOUTHEAST WING

MAMMALS OF THE WORLD

Continuing east from the hall where the apes and monkeys are, we pass the elevators, to enter the hall of the *Southeast Wing*, devoted mainly to a series of exhibits illustrating the characters of mammals, their principal groups, or orders, the main sub-divisions of these, known as families, and various interesting peculiarities of habits and structure. Walking around the room from left to right one passes from the egg-laying Platypus to man, represented by the figure of an Australian native, armed with the characteristic boomerang. Incidentally one sees the modifications of form and structure for various modes of locomotion, notices the superiority in brain of mammals over other vertebrates, learns that animals that outwardly look alike may be very distantly related, sees illustrations of albinism and melanism, and is shown how the coat of the hare changes from brown to white.

Above the cases is a frieze representing marine scenes, which serves as a background for groups of porpoises, dolphins, and other small members of the whale family. The most striking object in the hall is the life-size model of a sulphur-bottom whale, seventy-nine feet in length.

**Model of
Sulphur-
bottom
Whale**

The original of this specimen was captured in Newfoundland, and the model is accurately reproduced from careful measurements. This huge creature is not only the largest of living animals, but, so far as we know, the largest animal that has ever lived: a specimen of this size weighs from sixty to seventy tons, about twice as much as *Brontosaurus*. As can be seen by examining the models of a whale's head attached to the pillar, the whalebone which takes the place of teeth hangs in great plates from the inside of the upper jaw. This whalebone acts as a strainer in the mouth of the whale, and extracts the small animals from the sea water which the whale takes into his mouth when feeding. The food consists mostly of tiny crustaceans less than an inch in length. Although whales and porpoises live in the water, they are not fishes, but are warm-blooded and breathe by means of lungs, not gills. The whale must come to the surface to breathe and the so-called "spouting" is merely the result of the warm air being expelled from the lungs when he breathes. A whale does not spout *water*, as is commonly supposed. Models to scale of the other whalebone whales, and the toothed sperm whale, and reproductions of smaller whales and porpoises are hung near for comparison.

The plans for the next addition to the Museum building include a large hall to contain whales and other marine animals.

In the railing cases are exhibits which aim to give the visitor a general view of the enormous class of insects. This series is, at present, being extended and improved. When finished, it will include representatives of all the principal families, exotic as well as native. A special exhibit of the common butterflies near New York City and another of the "Moths of the Limberlost" have been installed. There is also one showing butterflies found in North Temperate America. There are nearly half a million species of insects in the world so that, even when finished, this series can contain only a small part of the total. Furthermore, many of the species would fade rapidly if exposed to the light. The general study collection of insects is on the fifth floor, and while it is not on exhibition, the curators will be glad to show it to visitors who can make use of it. See the Southeast Pavilion for the study collection of local insects.

SOUTHEAST PAVILION

HALL OF INSECT LIFE

Proceeding east, we enter the *Insect Hall*. The installations in this hall point out the relationships, through origin and mode of life, of insects to each other and to the other members of the Animal Kingdom, especially to man. The exhibits are arranged in a continuous series, and are numbered so that we can easily follow the plan beginning at the pillar farthest to the left and making two complete circuits of the hall.

Insect Life

First is an introductory section illustrating by diagrams the importance of insects as shown (a) by the large number of species compared with other animals [there are more species of insects than of all other animals put together] and (b) by their great influence on human interests. In the United States, the economic loss by insects is more than five times as great as by fire, and there are more than twelve times as many deaths from insect-borne diseases as from railroad accidents. On the other hand, many of our crops and all beautiful flowers are largely dependent upon pollination by insects.

Importance of Insects

Following this are a number of sections illustrating the anatomy of insects, explaining the terms used in the classification of insects, and exhibiting typical examples of the principal families.

Classification of Insects



GROUP OF MIGRATORY BUTTERFLIES

After a number of sections devoted to general phases of entomology such as the relationships of insects to each other and to other invertebrates, the color of insects, the four stages of an insect's life history, and the seasonal activity of insects, a series of exhibits is given which shows the principal insects of special situations and plants. Under the former heading we note aquatic insects and those associated with decaying material.

The exhibits concerned with insects associated with special plants lay emphasis upon those of economic importance and are followed by a study of household insects, insects and disease, and insecticides. It is shown that man's efforts to combat noxious insects is supplemented by the activities of lower mammals, birds, fish, reptiles, and of insects themselves.

Although certain insects destroy plants, some plants destroy insects. These and other ecological interrelations of insects and plants, including pollination, are shown on the east side of the hall.

Among insects are found carpenters, masons, weavers, papermakers, and other sorts of laborers. The making of silk is one of the principal insect activities, and several sections are devoted to silk, looking at it from both the entomological and the human viewpoints.

Following this, such subjects as art, the Bible and other literature, medicine, and superstition in their relation to entomology are treated. Photographs and short biographies of prominent entomologists of the past are given.

Evolution is a large subject, but the principal points involved in the present-day theories are illustrated in a series of sections treating



PART OF THE CICADA GROUP

such problems as mimicry, protective coloration, adaptation, variation, mutation, geographic distribution, selection, and inheritance (Mendelism).

Evolution of
Insects

The north side of the hall is devoted to social insects and their relatives. Here are found several groups showing the activities of these interesting creatures.

The final series includes a variety of things, being answers to the questions most frequently asked the curator by the general public.

Visitors desirous of studying the local insects more in detail are cordially invited to do so by consulting the nearly complete collection to be found in this hall under the custody of the New York Entomological Society.

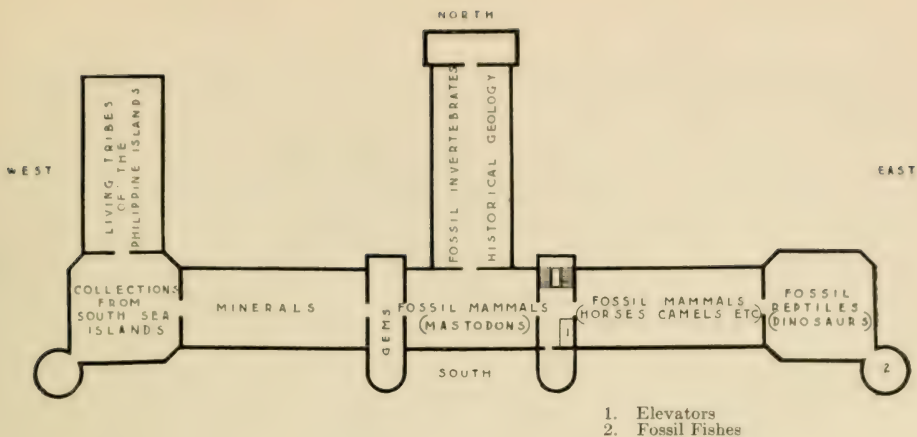
Local
Collection

It is primarily intended to be an aid in identification of specimens and is not a part of the general exhibition series.

[Return to the elevators and ascend to the Fourth Floor.]



ONE OF OUR COMMON HAWK MOTHS



FOURTH FLOOR

FOREWORD ON FOSSIL VERTEBRATES

In the *East Corridor*, and the *South Pavilion* at the left, as well as in the *East Wing* and *Southeast Pavilion* at the right, are displayed the fossil mammals, reptiles, and fishes.

In a general way, fossils are the petrified remains of plants or animals that lived at some past period of the earth's history. In many instances we have not the objects themselves, but only their casts or impressions in the rocks. This is particularly the case with shells. Sometimes, as with the bones of the great Irish elk, the objects have been buried in swamps or bogs, and in a few rare instances, as with the mammoth and woolly rhinoceros, entire animals have been preserved for thousands of years in ice or frozen mud. Fossils are found in localities where the dead animals or plants have gradually been buried under layers of sediment to such a depth that they come in contact with the mineral waters of the earth and finally become petrified. Later through subsequent upheaval and erosion they are again brought to or near the surface of the earth. Petrification is the slow replacement of animal or vegetable material by such minerals as carbonate of lime or silica. The process is very slow and for this reason flesh is never petrified. Fossil beds are found in every continent. In our own country, Texas, Montana, Wyoming, and the Bad Lands of South Dakota are famous for their large fossil beds, and many of the finest and rarest fossils in the Museum were obtained in these localities.

As it takes thousands of years for the various layers of earth to accumulate over the bones, and for the latter to become petrified, the study of fossils and the strata in which they are found is an important aid in determining the age of the earth and the succession of life thereon.

Many of the skeletons exhibited in these halls are of animals which lived from 30,000 to 20,000,000 years ago. To prepare a specimen for exhibition the matrix in which the bones are imbedded is carefully chipped away and the missing parts restored in cement and plaster. The bones are then assembled as in life. In the specimens on exhibition the restored parts differ in color from the original parts of the skeleton and can readily be distinguished.

As a whole, the Museum collections of fossil vertebrates are believed to be the finest in the world, if we take into consideration not merely numbers, but also variety, quality and perfected methods of preparation and exhibition. The collections illustrating the evolution of the horse are probably equal to those of all other institutions combined. The collections of Permian reptiles, of Jurassic and Cretaceous dinosaurs, of turtles, of North American Tertiary mammals, and of extinct mammals of South America, are likewise of the first rank. There are more than seventy complete skeletons on exhibition, several hundred skulls and nearly two thousand jaws or other parts of various species. About ten times this number are in storage, reserved for study and research, or not yet prepared for exhibition.

EAST CORRIDOR

FOSSIL FISHLIKE LIZARDS

Directly in front of the elevator is a wall case in which the most recently acquired specimens are placed. The cases attached to the wall near the stairway contain specimens of huge marine fishlike lizards, which show the tremendous pressure to which fossils are often subjected and the fragmentary condition in which they are found.

SOUTH PAVILION

HALL OF THE AGE OF MAN

The *South Pavilion* is devoted to early man, represented by a series of casts of the more noteworthy specimens, and to his contemporaries, the mammoths and mastodons and the giant ground sloths of South America.

On the left is a series of modern skeletons illustrating the evolution of the horse under the hand of man. Here are such extremes as the Shetland pony, only two feet ten inches high, and the rough-boned draught horse, which stands six feet one inch in height. Contrast these with the slender-limbed "Sysonby" the famous race horse, and the Arabian stallion "Nimr". The horse

Skeletons
of Modern
Horses


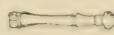
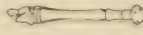
















THE GROUP OF GIANT GROUND SLOTHS

Fossil mammals from South America adapted for digging above the roots of trees for the purpose of pulling them down to feed on the leaves and twigs.

(See Leaflet, *THE GROUND SLOTH GROUP* for a full description.)

THE EVOLUTION OF THE HORSE.

		Formations in Western United States and Characteristic Type of Horse in Each				Fore Foot	Hind Foot	Teeth
Quaternary or Age of Man	Recent Pleistocene	 <p>Equus</p>				 <p>One Toe Splints of 2nd and 4th digits</p>	 <p>One Toe Splints of 2nd and 4th digits</p>	 <p>Long- Crowned, Cement- covered</p>
	Pliocene					 <p>Three Toes Side toes not touching the ground</p>	 <p>Three Toes Side toes not touching the ground</p>	 <p>Short- Crowned without Cement</p>
Tertiary or Age of Mammals	Miocene	 <p>Protohippus</p>				 <p>Three Toes Side toes touching the ground; splint of 5th digit</p>	 <p>Three Toes Side toes touching the ground</p>	 <p>Short- Crowned without Cement</p>
	Oligocene					 <p>Four Toes</p>		
	Eocene					 <p>Four Toes Splint of 1st digit</p>	 <p>Three Toes Splint of 5th digit.</p>	 <p>Short- Crowned without Cement</p>
Age of Reptiles	Cretaceous	 <p>Protorohippus</p>						
	Jurassic Triassic					 <p>Hyracotherium (Eohippus)</p>		

Hypothetical Ancestors with Five Toes on Each Foot
and Teeth like those of Monkeys etc.

The history of the evolution of the horse through the Age of Mammals gives the best example in existence of the doctrine of evolution by means of natural selection and the adaptation of a race of animals to its environment. During three millions of years these animals passed through important changes, especially in the teeth and feet, adapting them more and more perfectly to their particular environment—namely, open plains with scanty, stunted herbage.

lover will also be interested in the osteological collections in the wall cases which show how to tell the age of horses through the growth and development of the teeth.

Beyond the Horse exhibit on the left are fossils from South America, the most striking of which is the group of giant ground sloths. There are also good examples of the Glyptodon, a gigantic relative of the armadillo, of the camel-like *Macrauchenia*, the rhinoceros-like *Toxodon*, and other strange extinct animals which evolved in South America during the Age of Mammals, when it was an island continent, as Australia is to-day. Here, too, is the great sabre-tooth tiger, one of the host of northern animals that invaded the southern continent upon its union with the northern world, and swept before them to extinction most of its ancient inhabitants.

In the center of the hall is a skeleton of the giant carnivorous dinosaur *Tyrannosaurus* excluded from Dinosaur Hall for lack of space. To the right is a small collection of fossil remains of man illustrating what is known of the prehistoric record of our own race.

The principal exhibits on the north side of the hall are the mammoths and mastodons and the series of skulls showing the evolution of the elephant. The "Warren Mastodon" is a classic specimen. It was found near Newburg, N. Y., in 1846, and is the finest specimen of its kind that has ever been discovered. Next to it is a fine skeleton of the mammoth; portions of skin, hair and other fragments of a mammoth carcass discovered in Alaska are also shown. While modern elephants are confined to portions of Asia and Africa, fossil remains of elephants and mastodons show that, at one time or another in the past, they were found over the greater part of the northern hemisphere.

The skeleton of an African elephant, the once famous Jumbo, whose name has been embodied in the English language as a term for anything unusually large, is shown for comparison with its extinct relatives.

[See *Handbook No. 4, Animals of the Past*, and *Guide Leaflet No. 43, Mammoths and Mastodons*.]

SOUTHEAST WING

HALL OF THE AGE OF MAMMALS

FOSSIL MAMMALS OF THE TERTIARY PERIOD

Return to the East Corridor and continue into the *Southeast Wing* or Tertiary Hall which contains the Fossil Mammals of the Tertiary Period.

The geological age to which all the fossils shown in this hall belong covers a period of from 100,000 to 3,000,000 years. At each side of the entrance are charts indicating the successive periods of time from the Triassic to the Tertiary, and the animal life which pertained to each.



Restoration of Eohippus, the four-toed horse. This ancestor of the modern horse, scarcely larger than the red fox, lived some three millions of years ago. It comes from the Lower Eocene of Wyoming and New Mexico.

Careful guides and exhaustive cards of explanation, photographs, and window transparencies combine to make the entire exhibit illuminative and interesting.

The particular feature of this hall is the wonderful series in the cases by the entrance and in the first alcoves on the right showing the evolution of the horse in nature. The Museum is justly proud of this collection. Not only is it the largest and finest series of fossil horse skeletons in the world, but it is larger than the combined collections of all other institutions, and it con-

Evolution
of the
Horse

tains the earliest known ancestors of the horse, the little four-toed *Eohippus*, which was no bigger than a fox and on four toes scampered over *Tertiary* rocks. As will be seen by an examination of the skeletons of the horse and man, the modern horse walks on the tip of his middle finger and toe. The front hoof bone corresponds to the last joint of the third finger in the human hand, and the other bones of the leg correspond bone for bone with the structure of the finger, wrist and arm of man. The similarity in structure of the skeletons of horse and man is brought out in the exhibit of a rearing horse being controlled by man. A comparison of these two skeletons will show that although very different in proportions the bones of the one correspond with the bones of the other. In the modern horse the remaining fingers or toes of the fore and hind foot have entirely disappeared, or remain only as vestiges, the so-called "splint bones." The structure of the modern horse shows that it developed from a five-toed ancestor. This ancestry has been traced back to the four-toed stage. [See *Guide Leaflet* No. 36. *The Evolution of the Horse*.]

In the wall case at the right of the entrance is given a synopsis of the evolution of the foot and skull of the horse and the geological age in which each stage is found. Across the alcove the visitor will find the skeleton of *Eohippus*, the four-toed stage of the horse and the earliest form that has been discovered. This specimen is from the Wind River beds of Wyoming and may have lived 3,000,000 years ago. It is interesting to note that while there were no horses found in this country by the white settlers, America is the original home of the horse.

Passing from skeleton to skeleton the changes that have taken place in the development of the horse are easily distinguished. The exhibit is made more lifelike by plaster restorations of the animals and by water-color sketches showing primitive horses in their environment. These paintings and models are by Charles R. Knight. In the later types of the three-toed stage the two lateral toes have lost their original function of support and are gradually becoming vestiges. The three-toed horse in the center of the alcove is one of the most complete and finest examples that has ever been unearthed.

Opposite the horse exhibit on the other side of the hall, are series of specimens illustrating the evolution of the camel, deer and other cloven-hoofed animals. These animals like the cow of to-day walked on the tips of the third and fourth fingers, and the gradual disappearance or reduction to useless vestiges of the other fingers and toes can be traced as in the horse series.

The large blocks showing groups of skeletons of early camels, Camels skulls and bones of primitive ruminants in their natural



TYRANNOSAURUS, THE GIANT CARNIVOROUS DINOSAUR

A man would have been but a mouthful for this latest and largest of flesh-eating dinosaurs. This skeleton is temporarily installed in the Hall of the Age of Man. It is far more ancient than the fossils in that hall, for it lived during the Cretaceous Period, over three million years ago.

position in the rock, show how these specimens are sometimes found and raise questions as to how they got there, more easily asked than answered. The giant pigs, or *clotheres*, and the pygmy hippopotamus will repay examination.

The primitive rhinoceros-like animals are shown near the center of the hall on the right. It seems hard to believe that our vast western country and indeed all North America was once the home of the rhinoceros. As here indicated great herds roamed over the fields in the Tertiary Period and their fossil remains are found



Restoration of *Brontosaurus*. One of the largest of the amphibious dinosaurs, cold-blooded, slow-moving, unintelligent creatures that grew to large size (65 ft. in length) in the rich vegetation of the Reptilian era.

imbedded in the sandstones and clays of the badland formations. Opposite these are shown the ancestors of the dogs, cats and other carnivores and the *Creodonts* or *Primitive Carnivores* of the early Tertiary. Next to these are the small mammals—the insectivores, rodents and marsupials; and the fossil lemurs and monkeys, fragmentary but interesting because of their bearing on the ancestry of man.

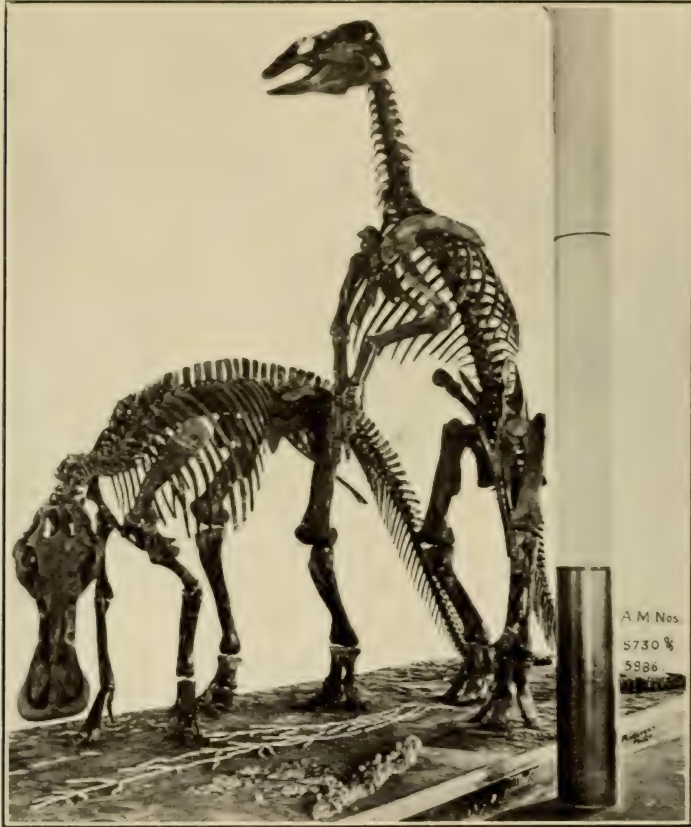
On the south side on the right are skeletons of *titanotheres*, on the left of *uintatheres*, huge extinct, horned animals peculiar to North America.

SOUTHEAST PAVILION

DINOSAUR HALL

FOSSIL REPTILES, AMPHIBIANS AND FISHES

The visitor now enters the *Southeast Pavilion* containing the dinosaurs and other fossil reptiles and also fishes. These animals belong to a more ancient period than the specimens just examined. They lived from



DUCK-BILLED DINOSAURS, TRACHODON

3,000,000 to 10,000,000 years ago. They include the well-known dinosaurs of which the Museum has a large collection. In the wall case on the left is a portion of the skeleton of the dinosaur *Diplodocus*; this was the first of these specimens to be unearthed by the Museum, while on the right is a nearly complete skeleton of another dinosaur (*Saurolophus*) mounted as it lay when, three millions years ago, it settled to the bottom of a western lake where it was gradually covered with sand and mud and slowly turned into stone.

The gigantic skeleton in the center of the hall is the huge extinct reptile, the dinosaur *Brontosaurus*, found in the Jurassic beds of Wyoming. It is the only mounted specimen of its kind in the world and more than two-thirds of the skeleton is the original petrified bone. It is sixty-six feet eight inches in length, sixteen feet in height and is estimated to have weighed when alive thirty-five tons. *Brontosaurus* is one of the largest giant reptiles and as is indicated by its teeth was herbivorous, probably living on the rank water weeds of the nearly sea-level marshes of Wyoming. Contrasted with the herbivorous *Brontosaurus* is the carnivorous dinosaur *Allosaurus*, mounted to represent the animal feeding on the fallen carcass of a *Brontosaurus*, upon which it preyed.



Section of the skin of *Trachodon* showing the small scutes with which the animal was covered. About natural size.

This is not a fanciful mounting, for these very skeletons were found in close proximity to each other in the Jurassic beds of Wyoming, and the skeleton of the fallen *Brontosaurus* shows gouges made by the teeth of *Allosaurus* as it tore the flesh from its victim.

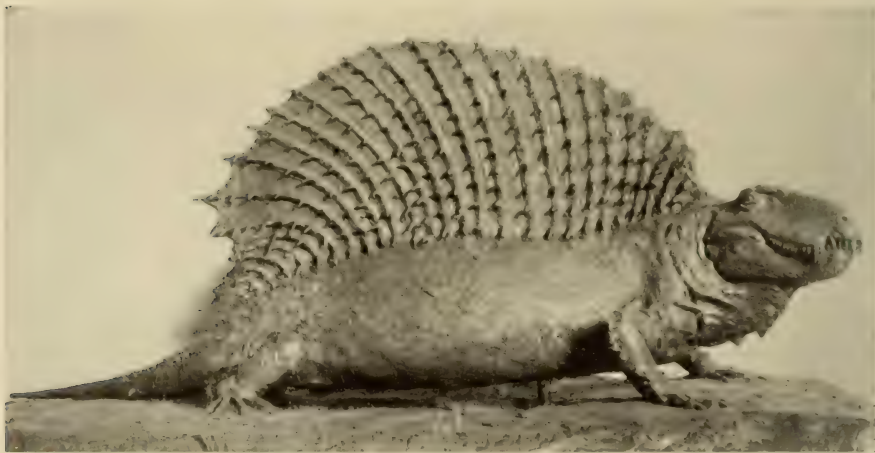
Near the *Allosaurus* group is a portion of a skeleton of *Tyrannosaurus*, the last and most powerful of the carnivorous dinosaurs. A complete skeleton is temporarily placed in the Hall of the Age of Man, as there is not room for it in the Dinosaur Hall.

To the left of *Brontosaurus* are two complete specimens of the duck-billed dinosaur *Trachodon*. One shows the animal erect and standing on guard, while the other is shown feeding on shellfish and plants of the Cretaceous swamps of Montana.

**Mummied
Dinosaur**

Most wonderful perhaps of all the specimens shown here is a "mummy" of *Trachodon* in which the texture of the skin is preserved. The animal is lying on its back and, in spite of its crushed condition, its form is easily distinguishable. It probably died on a sand bank or near a shoal where the hot winds dried up the flesh until the skin adhered to the bones like a close-fitting glove, and was subsequently buried by a flood.

Other specimens shown in the hall include the smaller carnivorous dinosaurs, the horned dinosaurs with, in one instance at least, a skull seven feet in length, and giant birds possessed of teeth. There is also the



RESTORATION OF NAOSAURUS

One of Nature's jokes. Professor Cope, who was also a joker, suggested that the high fin served as a sail, by means of which *Naosaurus* sailed over the lakes near which it lived.

finback lizard, one of the most ancient of fossil reptiles; *Diadectes*, a reptile with a solid-boned skull and *Eryops*, a primitive amphibian. The finest collection of fossil turtles in the world will be found on the south side of the hall.

[See *Handbook* No. 5, *Dinosaurs*.]

In the *Tower* of the Southeast Pavilion are displayed the fossil fishes which belong to a much earlier period than the mammals and reptiles, some of them having lived twenty to fifty millions of years ago. Many of these forerunners of back-boned animals are quite unlike any living fishes and are probably only very indirectly related to them; some were small, curiously encased in shells; others, shown in the three cases in front of the visitor, attained large size and were evidently formidable creatures. One of them in

Fossil Fishes



RESTORATION OF THE JAWS OF A FOSSIL SHARK

This largest and most formidable fish, living or extinct, of which we have any record, frequented the coast of South Carolina in Tertiary time. The jaws measure nine feet across; estimated length of fish, eighty feet, as large as a sulphur-bottom whale.

fact, *Dinichthys*, shown in the middle of the gallery, was probably among the most destructive creatures that ever lived in the sea. Its jaws were so strong that it could crush a plate of bone as thick as one's hand. Such an actual specimen, fractured in life and showing the marks of "teeth" is shown in a neighboring case.

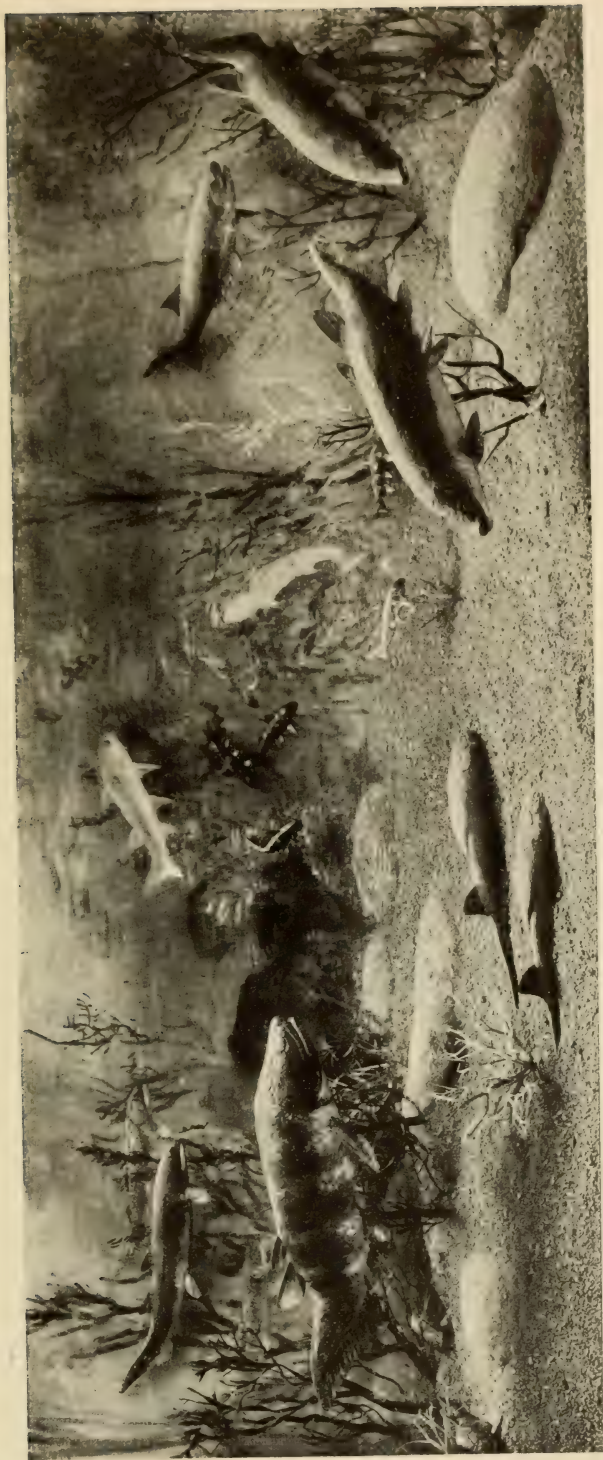
The collection is so arranged that he who makes the tour can see the principal kinds of fossil fishes and is able, in a measure, to outline the history and pedigree of the entire group. He can trace the rise and fall of the early plate-covered fishes; the era of the sharks which on the one hand supplanted the earliest fishes and were in time replaced by the more efficient lungfishes and ganoids; the age of ganoids when the waters were filled with these enamel-scaled fishes; finally the age of the bony-fishes, or teleosts, the multitudinous forms of to-day, the herrings, cods, perches, whose methods of swimming, feeding and breeding are far more efficient than those of any of their predecessors.

Above the entrance are the jaws "models", spreading nine feet, of a huge fossil shark in which the actual teeth are arranged as in the sharks of to-day, in the usual banks or rows—the teeth in the hinder rows serving to replace those in front, nature having dealt more kindly in the matter of teeth with sharks than with man. Such a shark probably measured from seventy to ninety feet and its race may well have become extinct, when for various reasons the enormous volume of food necessary to support it could not be maintained within its range of sea.

In the first alcove to the left, by the window, is a "fossil aquarium" in which a number of models of these earliest fishes are arranged in a group, as though alive in the sea.

In the next alcove are the early fossil sharks which superseded the tribe of plated fishes just mentioned. These sharks had soft skeletons, simple fins and a number of other primitive features which lead to the belief that all of the higher fishes, and the higher back-boned animals therefore as well, were descended from them, their simpler structures becoming more complicated in many directions. In one of the early sharks here exhibited, impressions of soft parts such as muscles and gill filaments have been preserved.

In the third alcove appear rare fossils of silver sharks or Chimæroids, which appear to have been developed from a primitive race of sharks. Curiously enough fossil egg capsules of these forms are sometimes preserved, and examples are here present. In neighboring cases are shown ancient lungfishes and ganoids—groups from which all land-living quadrupeds are believed to be descended.



THE "FOSSIL AQUARIUM" IN THE FISH GALLERY

This shows what can be done to make these ancient forms appear as living. The group illustrates the typical "Age of Fishes," Devonian, in which the forms rather than a single locality (Cromarty) and a single rock layer in the Old Red Sandstone of Scotland. The seaweed is also a restoration, modeled from impressions of the same age. Cromarty is noteworthy, not merely for its deposits of Fossil Fishes but for being the birthplace of Hugh Miller, whose discoveries and descriptions did so much to make the fishes known alike to the scientific world and the general public.

In the fourth alcove are shown the ganoid fishes which dominated the waters during the Age of Reptiles. They were of many kinds and sizes, most of them with lozenge-shaped scales of bone, with enamelled surface. One of the few survivors "*Amia*" of this ancient group is here shown living "in a window aquarium", to give the visitor a clearer idea of the fishes of the "Middle Ages" of the world.

In the fifth alcove are the petrified fishes of the Age of Mammals. By this time nearly all of the primitive fishes, like sharks, lung-fishes and ganoids, had become extinct; and the common forms were bony-fishes, or teleosts, closely related to our herrings, perches, mackerels and daces.

[Return to the South Pavilion or Hall of Mastodons and Mammoths.]

SOUTH CENTRAL WING

GEOLOGY AND INVERTEBRATE PALÆONTOLOGY

Turning northward at the center of the Quaternary Hall containing the mastodons and mammoths, the visitor enters the *South Central Wing* of the building and is in the Hall of Geology and Invertebrate Palæontology. Palæontology is the science of the ancient life of the earth; its field is the study of the fossilized shells and other hard parts and the various kinds of imprints left by the animals formerly inhabiting the seas and lands, and preserved in deposits which now form our stratified rocks. As normally the upper layers of a series of strata are more recent than the lower, the fossils reveal the succession of life forms in the earth's crust and thus are of the highest value and interest to the student of historical geology. Since, however, the remains of only a small proportion of the animals living at a given period are permanently preserved in the marine, river, lake and subaerial deposits of that period, the geological record of animal and plant forms is far from complete. Inasmuch as invertebrate animals are far less free in their movements than the vertebrate forms, they are accepted as the best determinants of the geological age of a bed of rock, even when remains of both kinds are found together. Invertebrate life, too, appeared on the globe far earlier than vertebrate, and remains of certain species are abundant in the lowest "oldest" of our stratified rocks.

In the alcoves of the hall is the general collection of meteorites, which is one of the largest and most representative in the country, containing as it does specimens from about five hundred of the seven hundred falls and finds that are known throughout the world. Some of the principal features of our collection are:

Two thousand or more individual masses from the "stone shower"

that fell near Holbrook, Arizona, in 1912. These have been arranged in a case by themselves.

The whole mass of Ysleta, a newly discovered "1914" iron meteorite, weighing 310 pounds from near the ancient village of Ysleta, New Mexico.

A series of polished and large etched slices of iron meteorites, including an entire section of the new Mt. Edith, Australia, mass, showing the Widmanstätten lines in great perfection, and polished slabs from several large stones meteorites. These are in a case by themselves which likewise contains several comparatively large entire single masses of some famous falls.

An exhibit of meteoritic masses, decomposition products, and country rock showing unaltered material and that which was melted and otherwise altered by the impact of the Canyon Diablo meteorite at the spot now known as Meteor Crater, Arizona. This exhibit has been loaned to the Museum by Princeton University.

In the desk cases down the center of the hall are the types and figured specimens used by James Hall, R. P. Whitfield and others in the original description and naming of species, or in their further elucidation.

The specimens in the cases on the left or west side of the hall are being arranged to illustrate stratigraphic geology, beginning at the south (entrance) with the Archean rocks, which are the lowest and oldest of all and contain no fossils, advancing regularly through the Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Jurassic, Triassic, Cretaceous and Tertiary. Most of the specimens on exhibition are from American localities and the species are arranged according to their position in the scale of life, the lower, or simpler forms being placed first. The specimens shown are those particularly characteristic of the various horizons, the object being to give an idea of the general character of the life of different periods of the world's history. The ends of the cases contain large or striking fossils.

The specimens on the east, or right, side are being arranged to illustrate biologic geology, the classification and relationships of the plants and animals of past geologic times. The series starts with the plants and is followed by the various sub-divisions of the animal kingdom, again beginning with the lower, or simpler forms and continuing to the highest.

In the first alcove on the right is the stump and part of the roots of a large tree from an anthracite coal mine under Scranton, Pa. Millions of years ago, in the geological period known as the Carboniferous, this tree grew upon the top of a



A BIT OF WEYER'S CAVE

Part of the section collected by W. B. Peters and P. B. Hill and installed by W. B. Peters.

thick swamp deposit of decaying vegetation which ultimately became a most valuable bed of coal. The stump was left in the roof of the mine when the coal was extracted for commercial and domestic uses. It fell to the floor years after the gallery had been abandoned and was discovered only through the chance visit of a miner.

Half way down on the east side is a desk case containing a series of rock specimens illustrating the geology of Manhattan Island. This is arranged geographically and shows the more prominent features of local geology from south to north.

The northeastern corner of the hall is devoted to the Copper Queen Mine Model and a series of ores and other specimens from the famous Bisbee-Warren copper district in southern Arizona. Two models have been prepared as a result of several years of extremely painstaking and skillful work.

A large model, some 18 by 12 feet in dimensions, shows on a scale of twenty-four feet to the inch all the surface features and mine and other buildings over four of the principal mines (Holbrook, Spray, Gardiner and Lowell) belonging to the Copper Queen Consolidated Mining Company, while a painted background represents the surrounding mountains and the town of Bisbee. The sides of the model give vertical sections to the depth of about 1200 feet illustrating the geology of the area and showing the general manner of getting out the ore and hunting for new deposits. There have been produced in about 30 years (1880-1912) from the mines at Bisbee belonging to this company 7,729,922 tons of copper ore of an average copper content of 7.16%. The metal production in this period was

Copper—1,106,605,774 pounds (553,303 tons)

Gold —104,775 ounces Troy (8,731 pounds)

Silver —6,107,421 ounces Troy (508,952 pounds).

Near the large general model there has been installed a small model on a scale of six feet to the inch showing the usual methods of extracting the ore by "stoping." Drilling, picking, timbering, filling old cavities, transporting, raising ore to the surface and other operations are illustrated as well as is practicable on the scale adopted. The shaft is equipped with its cages, which are arranged so that they go up and down by means of automatic machinery.

Specimens of ore, minerals and rocks from the mine and the adjacent country illustrate the geology of the region. Chief of these specimens are velvet malachites that were taken from the original "Queen" mine, the Open Cut, in the early eighty's and a great block of malachite and azurite weighing about four tons taken from the Mine in 1892 and exhibited in



THE COPPER QUEEN MINE MODEL AND ITS MAKERS

This wonderfully accurate model was presented by Dr. James Douglas. Its construction, aside from the necessary surveys, occupied three years.

the Arizona mining exhibit at the Columbian Exposition in 1893. Enlarged photographic transparencies give details of scenery and mining, supplementing what is shown by the models. The work of treating the ores at the smelter in Douglas near Bisbee is demonstrated in a neighboring case.

The northwest corner of the hall contains a display of caves and cave material including a reproduction of part of a beautiful cave that was discovered early in 1910 in mining operations at the Copper Queen mine. The cave was formed by the dissolving action of water traversing joints in limestone, and its walls, roof and bottom were afterward coated with calcite (calc spar) incrustations, stalactites and stalagmites, some of which are dazzling white while others are colored green with copper salts or pink with manganese compounds.

Alongside the Copper Queen cave is a reproduction of a chamber in Weyer's Cave, Virginia. Weyer's Cave is in a region of much heavier rainfall than Bisbee, which is probably the principal factor in producing a greater wealth of regular stalactite and stalagmite growth than adorns the Copper Queen cave, and this exhibit illustrates not only their great variety in form but the reasons for this extraordinary diversity.

Among the cave material shown nearby is a series of tumblers into which water from the stalactites was allowed to drip for stated periods, the thickness of the deposit giving some measure of the length of time necessary for the formation of stalactites and stalagmites.

Particularly attractive are the marvelously beautiful specimens of calcite, aragonite and gypsum from the famous silver- and-lead mines near Santa Eulalia in the vicinity of Chihuahua, Mexico. These specimens are remarkable for the perfection of their crystalline form or the delicacy of their fibrous developments and for their colors.

[Return to the Hall of Mastodons and Mammoths and turning to the right enter the West Corridor or Gem Hall.]

Chihuahua Cave Material



MOSS AGATES FROM HINDUSTAN
In the Morgan Gem Collection



CRYSTAL BALL
WEST CORRIDOR
GEMS AND PRECIOUS STONES

Gems and
Precious
Stones

The West Corridor contains the Morgan gem collection. This valuable series of gems and precious stones was presented to the Museum by Mr. J. Pierpont Morgan, one of the founders and a trustee of the institution, whose services to the country in the founding and up-building of the Museum are commemorated in a bronze tablet by Miss Longman at the south end of the hall. It comprises a representative assemblage of cut and uncut gems, many of the former of remarkable size and some of great purity of color. The installation aims to bring into juxtaposition the cut and uncut material, the former is arranged around the latter, in the center of the cases, and the visitor may thus observe the brilliancy of effect produced in the natural mineral by skillful artificial treatment (cutting).

A partial graduation in importance and value is obtained by the arrangement of the gems, beginning with Diamond at the extreme south and passing north, case by case (through Corundum (*Sapphire*), Beryl, (*Emerald*), Topaz, Tourmaline, Chrysolite, Spinel, Zircon (*Hyacinth*), Chrysolite (*Peridot*), Adularia (*Moonstone*), Opal, Amethyst, Kunzite, Amber, Pearls.) In one case a varied collection of semi precious or ornamental stones is shown, many of which are experimental efforts to use mineral material which can never have any very extended use, viz., prehnite, titanite, sphalerite, hematite, cyanite, etc., etc.

Handsome wall case specimens of large size line the sides of the Gem room, among which the Azurite, Malachite, Quartz, Amethyst, Gypsum and Tourmaline are preeminent for size or beauty.

SOUTHWEST WING

MINERALS

Next beyond the Gem Hall is the *Southwest Wing* or Hall of Minerals. At the entrance to the hall is a case in which recent acquisitions are placed. The general collection of minerals consists chiefly of the well-known Bement Collection which contains specimens representing species of the known minerals of the world. Not only is the collection noted for its numbers, but in many instances the beauty and size of the individual specimens are quite unsurpassed in other collections.

The more attractive specimens are displayed in cases arranged down the center of the room. The remainder of the collection is arranged according the classification of minerals. In the first cases on the right or left are models of the six systems of crystals and other introductory illustrations of the physical and optical properties of minerals. Each mineral has a characteristic form of crystallization which is one of the means of identifying it. The distribution of the more important minerals is indicated on maps.

SOUTHWEST PAVILION

COLLECTIONS FROM THE PACIFIC ISLANDS

On entering the Southwest Pavilion beyond the Hall of Minerals the visitor faces groups representing the natives of the Pacific Islands. Directly in front is a Tahitian priest taking part in the fire-walking ceremony, in which the participants walk over heated boulders of lava.

On either side are groups engaged in grating cocoanut, making kava, and weaving mats for a house.

In the entrance aisle is a Hawaiian feather cape, such as were worn by the kings and chiefs of Hawaii, especially in war. This specimen has been in America more than a century. The red and yellow feathers are taken from a species of honey sucker. The work required in obtaining the feathers and making the cape is very great.

The hall as a whole falls into two main divisions. On the east are the Polynesians and Micronesians who inhabit Samoa, Hawaii, Tahiti, Marquesas, the Gilbert, Marshall, and Caroline Islands.* Their



HAWAIIAN FEATHER CLOAK

weapons, mats, tapa cloth and the implements used in its manufacture are of especial interest. There are a number of models of canoes to remind us that these people are wonderful boatmen and adventurous seafarers. On the west side are the Melanesians of the Bismarek archipelago, the Solomons, New Hebrides, and New Caledonia. Especial attention is directed to their carvings in wood shown in the large case of sacred masks, and the poles on the case which resemble the totem poles of the Northwest coast of America.

Near the entrance to the tower are cases devoted to the natives of Australia, in which are their boomerangs, crude stone tools, and interesting ceremonial objects.

In front of the tower a Maori warrior is balanced on a large boulder

* The Fijians, while Melanesian in race, have a culture very similar to that of Samoa and are therefore represented in the same section of the hall.



GENERAL VIEW OF THE PHILIPPINE HALL

of jade in an attitude of defiance. Within the tower devoted to these native inhabitants of New Zealand is a series of dried, tattooed heads, grewsome relics of the time when Maori warriors preserved the heads of their vanquished enemies. In this tower, also, are specimens of carving in wood and stone. In the center is a model of a carved storage house. In one case are several examples of clothing, a feather cape, and woman's skirt.

In the northwest corner of the main hall are several cases devoted to New Guinea. The more prominent objects are nets, stone adzes, carving, and painted tablets and shields. Resting on the case by the doorway are two carved ancestral figures of considerable interest.

The hall due north beyond the Hall of the Pacific Islands is devoted to a collection from the Philippine Islands. Occupying the middle of the hall are several interesting groups and large objects. First is the model of a woman weaving a garment on a native loom. Next is the model of a small house with walls of bamboo and roof of thatch. Beyond the house is to be seen a sailing canoe, outriggered to prevent capsizing. The use of bamboo in

place of rope in the rigging of this canoe is of especial interest. At the very end of the hall is a native house perched in the top of a tree.

In the cases on the west side of the hall are arranged collections



TAHITIAN FIRE WALKER

relating to the Bagobo of Mindanao Island. In the several cases are to be found collections showing the native work in metals, the garments of native fibre decorated with beads, and a very interesting and quite complete exhibition of textiles, showing the materials, looms and finished products.

At the farther end of the hall are two cases given over to the representative peoples of the islands of Sumatra, Celebes, and Java, showing their knives and blow-guns.

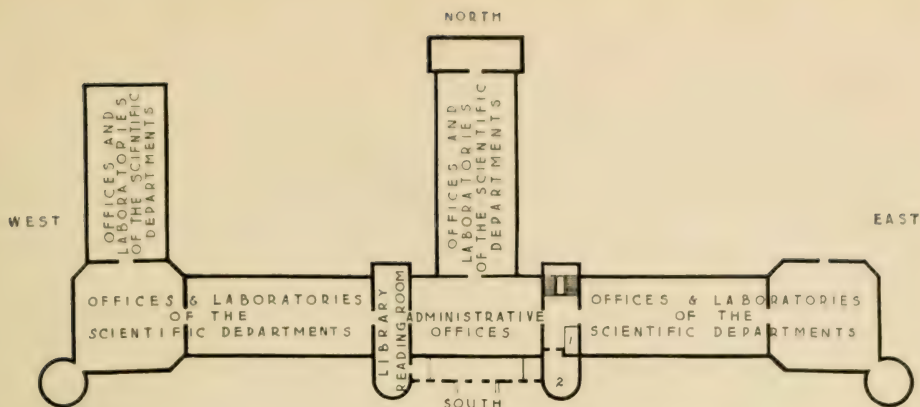
The Samal and Sulu Moros representing the Mohammedan population are next in order. Their war-like character is indicated by the predominance of spears, krises, and shields. There are also some examples of their work in pottery and basketry.

The Igorots of the Island of Luzon have examples of their metal work, weapons and shields, basketry and textiles displayed in cases midway of the hall on the east side.

The Negritos are of special interest because of their small size. They are pygmies and are believed to be descended from the first inhabitants of the island. In the case devoted to them are to be seen an interesting array of diminutive poisoned arrows and the accompanying bamboo quivers.



MAORI WARRIOR IN ATTITUDE OF DEFIANCE



1. Elevators
2. Office of the Director.

FIFTH FLOOR

The fifth floor is given over to the administrative offices, the offices and laboratories of the scientific departments and the library which contains some 70,000 volumes on natural history, anthropology and travel.

The library now contains over 15,000 volumes on zoölogy, comprising many of the extremely rare and interesting monographs in ornithology; an excellent collection of 3,500 volumes in entomology, including many of the rare classics, and a 2,000 volume collection in conchology containing the standard works of Küster, Reeve and Binney. There is also a well selected collection of 2,500 volumes in anthropology, including many of the older works relating to the North American Indian; an excellent collection of 3,500 volumes in geology enriched by the library of the late Professor Jules Marcou; a collection of 5,000 volumes in palæontology, to a large extent composed of the Osborn Library of Vertebrate Palæontology; also an unusually complete collection of more than 25,000 volumes of natural science periodicals.

The reading room of the library is located in the west corridor and, with the exception of Sundays and holidays, is open free daily, from 9 A. M. to 5 P. M., to all who may wish to consult the books. Besides the current issues of the more important periodicals, it contains the more general works of reference, while other volumes will, upon application to the librarian, be furnished to those who wish to consult them.

On this floor, too, are the workrooms of the Department of Vertebrate Palæontology, where the skeletons of fossil animals are prepared and mounted, and the laboratory where are made the beautiful models of invertebrates.

These, like the other laboratories, are of necessity not open to the public.

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POPULAR PUBLICATIONS
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HANDBOOKS

These deal with subjects illustrated by the collections rather than with the objects themselves.

- No. 1.—NORTH AMERICAN INDIANS OF THE PLAINS. By CLARK WISSLER, Ph.D., Curator of Anthropology. October, 1912, 145 pages, maps and illustrations. *Paper, 25 cents; cloth, 50 cents.*
This gives an account of the Material Culture, Social Organization, Religion, Ceremonies, Arts and Languages of the Plains Indians of North America.
- No. 2.—INDIANS OF THE SOUTHWEST. By PLINY EARLE GODDARD, Ph.D., Curator of Ethnology. March, 1913, 190 pages, maps and many illustrations. *Paper, 25 cents; cloth, 50 cents.*
A résumé of our present knowledge of these interesting Indians. Among the subjects treated are the Spanish Conquest, Cliff Dwellings, Native Weaving, the Potter's Art and the Hopi Snake-dance.
- No. 4.—ANIMALS OF THE PAST. A popular account of some of the Creatures of the Ancient World. By FREDERIC A. LUCAS, Sc.D., Director of the Museum. 250 pages with 41 illustrations by Charles R. Knight and Joseph Gleeson. *Paper, 35 cents.*
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- No. 5.—DINOSAURS, with special reference to the American Museum Collections. By W. D. MATTHEW, Ph.D., Curator of Vertebrate Palæontology. December, 1915, 162 pages, 48 illustrations. *Paper, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

These describe some exhibit, or series of exhibits, of special interest or importance, or may deal with the contents of an entire hall; some of the earlier leaflets are out of print.

- THE COLLECTION OF MINERALS. By LOUIS P. GRATACAP, A.M., Curator of Mineralogy. February, 1902. *Price, 5 cents.*
The minerals have been moved since this leaflet was issued, but it contains much information about the collection and a number of figures of interesting specimens.
- NORTH AMERICAN RUMINANTS. By J. A. ALLEN, Ph.D., Curator of Mammalogy and Ornithology. *Revised edition*, February, 1904. *Price, 10 cents.*

Describes the rapidly disappearing large game of North America, such as the Bison, Elk and Mountain Sheep.

THE BATRACHIANS OF THE VICINITY OF NEW YORK CITY.
By RAYMOND L. DITMARS, Curator of Reptiles, New York Zoölogical
Park. October, 1905. *Price, 15 cents.*

PERUVIAN MUMMIES. By CHARLES W. MEAD, Assistant Curator,
Department of Anthropology. March, 1907. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN
MUSEUM OF NATURAL HISTORY. By EDMUND OTIS HOVEY,
Ph.D., Curator, Department of Geology and Invertebrate Palæontology.
December, 1907. *Price, 10 cents.*

The collection, which represents about 500 falls, numbering some
2,000 specimens, includes the great "Ahnighito" meteorite, weighing
36½ tons, brought from Greenland by Peary, the strange
"Willamette" meteorite and the "Canyon Diablo" which contains
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THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By
FRANK M. CHAPMAN, Curator of Ornithology. *New edition*, May,
1916, 64 pages, colored frontispiece and 35 illustrations. *Price, 25
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These celebrated groups are designed to illustrate not only the
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THE EVOLUTION OF THE HORSE. By W. D. MATTHEW, Ph.D.,
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trations. *Price, 20 cents.*

The past geologic history of the Horse affords the most complete
and convincing illustration of evolution among mammals. This
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stages in its evolution from the four-toed "*Eohippus* no bigger than
a fox" to the single-toed horse of to-day.

OUR COMMON BUTTERFLIES. By FRANK E. LUTZ, Ph.D. Assist-
ant Curator, Department of Invertebrate Zoölogy. June, 1914.
Price, 15 cents.

Describes and figures natural size the common species (31 in all) of
the eastern United States.

HOW TO COLLECT AND PRESERVE INSECTS. By FRANK E.
LUTZ, Ph.D., Assistant Curator, Department of Invertebrate Zoölogy.
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REPRINTS

of Important Articles in the *American Museum Journal*.

THE GROUND SLOTH GROUP. By W. D. MATTHEW. April, 1911. Describes the structure and habits of these giant relatives of our sloths and anteaters. 8 pages, 4 illustrations. *Price, 5 cents.*

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GUIDE TO THE COLLECTIONS ILLUSTRATED

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KEY TO THE COLLECTIONS

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